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The Engineering and Mining Journal

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Lime in Cyaniding

In the early days of cyaniding opinions were divided as to the best alkali to use as the neutralizing agent in the cyanide process. The two that have been most generally considered for commercial operations are caustic soda and lime. While caustic soda was for a time in favor, at present the use of lime for this purpose is practically universal.

A consideration of the reactions involved in the use of each of these reagents shows that theoretically 1 lb. of lime is as effective as 1.4 lb. of caustic soda. This fact taken in connection with the generally lower price of the former adequately accounts for the choice, especially since soda possesses no marked superiority in any branch of the process.

Having adopted lime as the substance to be employed, the cyanide operator still has some problems to solve in applying it to his particular needs. In deciding where to add the lime, the character of the ore is an important consideration. If the ore produces slime difficult to settle, it is essential, according to one investigator, that the alkali be added before water is applied in order to minimize the formation of colloids. The practice in many mills is to add the lime at the rolls, chilean mills or stamps in quantity sufficient to keep the alkalinity up to requirements. In other mills, further additions are made at sand and slime tanks to provide for acidity developed during the process. At one mill the lime is withheld until after the pulp leaves the concentrator to avoid the formation of crusts of lime on the tables.

There still seems to be a difference of opinion as to whether it is better to use the lime dry or as an emulsion or solution. Those advocating adding the lime dry state that by this method it goes slowly into solution and is thus available at successive stages in the process, whereas with lime as solution all the alkali is available at once, so that besides neutralizing the natural acidity of the ore it may enter into other and needless reactions. Exponents of the lime-solution method are positive that greater economy and higher efficiency are possible by its use. The fact that both of these systems are in use in the same district under supposedly similar conditions shows that the question is still an unsettled one.

The size of the particles of lime is of importance when added dry, because if it is too fine it goes rapidly into solution and if too coarse some of the lime may be discharged with the tailings without having exhausted its usefulness.

The method of adding the lime varies at different mills. Where automatic feeders are not deemed feasible it is common practice to place the responsibility of adding the lime upon the attendant of the crushing or grinding apparatus. The objection to this is that no matter how conscientious the mill man may be his chief aim naturally is to keep his machines up to capacity and, if work presses, what to him are secondary duties are likely to be neglected.

It is advisable to have the addition of lime under the control of the metallurgist or someone who appreciates the importance of this part of the process. In some mills the use of automatic devices makes such control possible and affords a means of avoiding irregularities by eliminating the human element. If the neutralizing branch of the cyanide process is as important as many think it is, the same care that is used in feeding zinc dust should be exercised in the use of lime.

Miners' Wages

It is reported that the miners of Butte have asked for an increase in wages to $4 per day and that conferences respecting this are being held with Mr. Ryan. It is surmised also that a similar demand is brewing at Bisbee and in other important copper-mining districts. Following the recent advance at Lake Superior, where

wages have been restored to the level of 1906, it was to be expected that a similar action would be expected elsewhere. This is perfectly natural on the part of the miners, and their attitude is in no wise to be deprecated, but if it should prove that the recent advance in copper has been premature and overdone, the producers will have cause to regret their late enthusiasm. Restriction of consumption and increased cost of production are two of the consequences of intemperance in a commodity market.

Steel Making in 1911

The total production of steel in the United States, in 1911, as heretofore noted, was 23,675,501 long tons. This was 2,419,418 tons, or 9.2% less than in 1910, but only a little below the total of 1909, and was slightly above that of the boom years of 1907 and 1906. The last named fact indicates the increase in capacity in the past three years, since the make in a year considered to be one of comparative depression exceeded that of years when all our works were being forced to their full capacity.

The make of steel last year, as shown in the tables below, was again marked by an important increase in the proportion of openheath steel, and especially of basic steel. Another noteworthy fact is that the make of steel in 1911 exceeded that of pig iron by 46,157 tons. This is a condition never reported before in this or in any other large steel-making country. In fact, it has happened only in one or two European countries—as in Italy—where one or two large works make steel from imported pig iron. The excess production of steel last year is explained by two facts well understood in the trade. One is that at the close of 1910 there were on hand unusually heavy stocks of pig iron, estimated at more than 2,000,000 tons, and that a considerable part of these stocks was used for conversion into steel in 1911. The other was that during a large part of the year there was an abundant and relatively cheap supply of steel scrap, which led to the use of an usually large proportion of scrap in the openhearth furnaces. This second fact is confirmed by the fact that the decrease in basic openhearth steel, as compared with 1910, was proportionally less than that in basic pig iron.

The division into acid and basic steel was as follows:

	Acid		Basic	
	Tons.	Per Ct.	Tons.	Per Ct.
Bessemer(conv'ter)	9,947 849	33.6	.....	....
Openhearth.....	912,718	3.9	14,685,932	62.0
Crucible, etc.....	129,002	0.5	.....	....
Total.....	8,989,569	38.0	14,685,932	62.0

All our converter steel is made by the acid process, the basic converter not being in use in this country. It is assumed also that the small quantities of crucible and special steels made are acid steel. Basic steel is rapidly approaching the point where it will constitute two-thirds of our production. Over seven-eighths of the acid steel is made in the converter, and the proportion of acid openhearth metal does not increase. In 1910 it was 4.6% of the total. Comparing the converter and openhearth processes, we find that in 1911 converter steel was 33.6% of the total, while openhearth was 65.9%, special steels being 0.5% only. In 1910 openhearth was 63.2% of the total.

The growth of the openhearth process in recent years is strikingly shown in the following table, which gives the total steel production of the United States for 10 years past, in long tons:

	Converter	Openhearth	Crucible, etc.	Total
1902.	9,138,363	5,687,729	121,158	14,947,250
1903.	8,592,829	5,829,911	112,238	14,534,978
1904.	7,859,140	5,908,166	92,581	13,859,887
1905.	10,941,375	8,971,376	111,196	20,023,947
1906.	12,275,830	10,980,513	141,893	23,398,136
1907.	11,667,549	11,549,088	145,309	23,361,946
1908.	6,116,755	7,836,729	69,763	14,023,247
1909.	9,330,783	14,493,936	130,302	23,955,021
1910.	9,412,772	16,504,509	177,638	26,094,919
1911.	7,947,849	15,598,650	129,002	23,675,501

Comparing 1911 with 1902, we find that while the total make was 8,728,251 tons greater last year than it was 10 years ago, the quantity of converter steel was actually less by 1,190,514 tons,

COMPARISON OF U. S. AND GERMAN STEEL PRODUCTION

	United States		Germany	
	Tons	PerCt.	Tons	PerCt.
Acid converter...	7,947,849	33.6	187,359	1.3
Acid openhearth	912,718	3.9	383,895	2.6
Total acid.....	8,860,567	37.5	571,254	3.9
Basic converter..	.....	.....	8,640,164	57.5
Basic openhe'rth	14,685,932	62.0	5,668,501	37.7
Total basic....	14,685,932	62.0	14,308,665	95.2
Crucible, etc.....	99,897	0.4	78,760	0.4
Electric.....	29,105	0.1	60,654	0.5
Total.....	23,675,501	100.0	15,019,333	100.0

while the openhearth steel make was greater by 9,910,921 tons. The figures for crucible steel show little change.

The quantity of special steels in 1911 was made up of 97,653 tons crucible, 29,105 tons electric and 2244 tons made by various experimental and special processes.

It is of interest to compare the production of the two great steel-producing countries in 1911, with special reference to the processes used. The British figures are not yet available. The figures for the United States in the accompanying table are in long tons; for Germany in metric tons.

The production of basic steel in the two countries differed by only 377,267 tons, but over 60% of the German basic steel was made in the converter. Our excess of 7,556,168 tons over Germany last year was wholly in acid steel, which is less than 4% of the German make.

It appears from statements in the daily papers that the great potash deposit recently discovered in California by the U. S. Geological Survey is all privately owned. We suppose that it is a duty of the Geological Survey to assist the citizens of the country in the exploitation of their resources, i.e., if someone has got a diamond mine that he does not know about and the Geological Survey discovers it, certainly the owner ought to be told about it. There would be some excuse for the failure to recognize diamond-iferous ground, but when a man or a company owns a potash lake and does not know it, there is something of a reflection upon his intelligence, not because he himself failed to recognize what he had, but because he neglected to obtain expert advice. The most interesting question will arise when the Geological Survey discovers some enormous deposit of potash or saltpeter in the public domain that has been withdrawn from entry. As to the potash discovery in California, we think it will be well to await some commercial report before waxing too enthusiastic.

The smelters' production of copper in the United States, plus imports of foreign blister copper and copper in ore and matte, was 127,885,749 lb. in February, against 139,027,356 lb. in January, a smaller importation of blister copper accounting for the decrease. The production reported by the refiners was 116,-035,809 lb. in February and 119,337,-753 lb. in January, the smelters' figures thus exhibiting a surplus of 31,539,543 lb. during the first two months of 1912.

By the Way

Besides other troubles due to the disturbed conditions in Mexico, the Mexican *Mining Journal* had the misfortune on Apr. 20 to lose its entire printing plant by fire. The publishers announce that the plant is being rebuilt and ask the indulgence of subscribers in the delay entailed in getting out the May issue which was in press at the time of the fire.

Apropos of racial peculiarities, the Welsh are not always without them. There were once two brothers worked in a copper smeltery who always arrived at the plant about 20 ft. apart. Inquiry revealed that they lived in adjoining houses, and the one in the farther house started first, knocking on his brother's door as he came by. The second then started but never would hurry to catch the first, nor would the first wait for his brother to catch up.

We do not often venture upon any prophecies respecting the monthly report of the Copper Producers' Association, but if we could make up our minds to break our rule, we should be inclined to forecast an increase in the stock during April. The thought has occurred to us, however, that inasmuch as the refiners are always doing the unexpected, the output of refined copper in April may shrink by 10 or 15 million pounds, wherefore we feel that after all we shall best refrain from prophesying.

Leading a more or less open-air life, mining engineers have not been worried so much by germs, etc., as some other professional men. Still, they have had to do with the ankylostomiasis worm and other strange animals. Now they are introduced to a new one by T. P. O'Conner, the well known apostle of home rule for Ireland. In his otherwise serious and literary paper, *T. P.'s Weekly,* he gravely retails the following story of a metal-eating worm: "A more feasible explanation of the disease which attacks old metal coins is suggested by the recent discovery by some Italian engineers of a microbe which feeds on iron. The discovery was made through the frequency with which railway accidents occurred in one particular portion of the railroad in a certain district. An examination of the rails was made, and the presence of severe corrosion was revealed. A rail was taken up and broken. It was then found to be hollow, and further examination showed the presence of a thin, gray, thread-like worm, about a third of an inch in length. A careful examination was made of the habits and appearance of this worm. Upon its head it carried two little glands filled with a corrosive secretion, which it ejected every few minutes on the iron. The ejection had the property of rendering the iron soft and spongy, when the worm at once proceeded to devour it." Rand mining magnates, writes a Johannesburg correspondent, are going to put an embargo on Italian imports. If the Italian worms are slick enough to evolve an acid that will digest steel rails, there is no knowing but that transplanted to new surroundings, they might start dissolving gold out of the banket ore. Or managers might be offering excuses for failing to keep the mills going, such as "worms in the stamp heads," or "No. 7 level stopes simply eaten out by the grubs," and almost anything might happen to the gold reserve, assuming that any mine were now bold enough to keep one in its family-skeleton closet.

In Prof. R. Pumpelly's book "Across America and Asia," published in 1870 and based in part on some very strenuous adventures in 1860-61 as engineer-in-charge at the Santa Rita mines near Tubac, south of Tucson, Ariz., is this paragraph: "The nearer an ancient mine may be to the heart of the Apache stronghold, the more massive the columns of silver left standing as supports at the time of abandonment. It is not strange, therefore, when we consider how easily our people are swindled in mining matters, that we find them lending a willing ear to these tales, and believing that in Arizona the hoofs of your horse throw up silver with the dust." That Professor Pumpelly's observations made nearly half a century ago have a decided resemblance to some present-day wisdom is in proof of the doctrine that human nature is very persistent in its characteristics.

Many young gold fields have started out brilliantly, but their careers have been blasted by wild extravagances, hot blasts of brokers' literature, gambling and other dissipations. No wonder the Rand became a great gold field. Consider the early advantages it enjoyed. Rev. David Russell, of Johannesburg, speaking before the Men and Religion Forward Movement, in New York, related some early experiences: "I was preaching at Pietermaritzburg when a man came in from the newly discovered gold fields. He told me there were two or three hundred miners without a preacher or church. . . . . He was eager that the diggers should hear the Gospel. I went, and shall never forget the first service in the public square, with two hundred miners clustered about. . . . . We had no place for an after meeting, but there was an unoccupied building, with a storeroom on one corner. There were no doors or windows and the place was to be a liquor warehouse. We got some planks and some boxes and made seats. Gen. Joubert, the Boer guerilla, who never was captured, was one of the audience. We held indoor meetings there for several days. The diggers learned the Gospel songs and we were told they rang through the valley for several miles. In 10 days the owner of the warehouse said we must get out, as his stock had arrived, but I got him to let us use the floor by guaranteeing him against the pilfering of goods. The digger men stacked cases of beer up in one end of the room, to provide seats much like your theater galleries. The platform was made of twelve big brandy cases—filled—and for the pulpit I set up two cases of gin, covered with my traveling rug. They told us there must be lots of spirits in our church. But the place was filled with eager men and that justified the occupation of the liquor warehouse."

The "dead miner" swindle, a variation of the "Spanish prison" scheme, has just come to grief. George W. Post, alias William A. Carter, pleaded guilty on Apr. 26 in the district court of New York to four indictments for having used the mail to defraud, and was sentenced to three years and six months and $11,000 fine. Post, who is a distinguished looking man of 65, used to work with E. A. Starkloff, alias Seaver or Sheldon. Their favorite plan, says the Times, was to write to the heirs of some person who had recently died in England, Germany or France, stating that a poor miner who had been assisted by the deceased had at last found a valuable mine and wished to reward his benefactor. Many who received these letters answered them and were then informed that by putting up a sum of money valuable mining rights could be obtained in Cripple Creek or some other well known district. Some of the victims sent money, and if cautious enough to come to this country, Post and Starkloff would send them home carefully guarding a trunk containing brass fillings, under the belief that it was virgin gold.

A London expert who was sent to report on a mine in Gilpin County, Colorado, tells the shareholders that "the positive ore developed amounts to 135,545 tons of an average assay value of $9.35 per ton. The probable ore amounts to 95,025 tons of an average assay value of $9.22 per ton. The ore expectant amounts to 220,082 tons of an average assay of $9.22 per ton." Note the 22c.! It is a well known fact that a metallurgist and mining engineer in that state, estimated to within a few cents per ton what it would cost to mill an 800,000-ton dump, and within a few dollars of how much profit per month he could extract in two years—and subsequently *did* it. But the other totally eclipses this—on paper—and knocks into a cocked hat the old adage "you cannot see an inch ahead of your pick's point." It simply shows what marvelous advance science is making in the art of mining when the value of 315,107 tons of "probable and expectant ore" can be given within a cent to the shareholders expectant.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Test for Vanadium

In the April issue of a contemporary of the JOURNAL, appears the following test for vanadium:

"A simple method of testing a mineral to determine whether or not it contains vanadium is to digest it with nitric acid and then add hydrogen peroxide to the resulting liquid. The formation of a brown color indicates the presence of vanadium."

I use a sulphuric-acid solution instead of nitric, and the addition of peroxide gives a wine color. If the substance is not readily attacked by sulphuric acid it may be put in solution by any other acids, evaporated to dryness and sulphuric acid added. I believe this test is more delicate.

B. A. STATZ.

Albuquerque, N. M., Apr. 16, 1912.

Where Should the Primer Go?

It would seem that such a question after being so thoroughly discussed would by this time be practically settled. However, none of the numerous articles that has appeared recently in the JOURNAL, has fully agreed with my experiences, nor has it given sufficient reasons for the views expressed and the conclusions reached by its writer.

Mr. Gunsolus states that no difference was noted, in experiments made by the du Pont company, whether the primer cartridge was placed first or last.

In my opinion the reason for no difference being noted lies in the fact that an excess of powder must have been used, enough in all probability, to break two holes of the kind loaded, as this is invariably the case in underground work, even when the loading is done by the most experienced men and in ground with which they are perfectly familiar. The rule that it is better to overload than to have a round fail is not a bad one.

Let whoever will, load two 10- or 12-ft. holes that have reasonably heavy burdens. Fill them to the brim with an inert explosive, such as a gelatin dynamite or one of the newer explosives of the non-nitroglycerine type. In one of them place the detonator in the bottom or near it, with the closed end pointing out; in the other place the detonator last, the business end always pointed toward the body of the powder. He will certainly see the difference in a case of this kind. Again, load any hole, or better, a number of holes, with an inert powder and place the primer last with the closed end of the cap pointed away from the body of the powder. In a great number of cases the cartridge containing the detonator will explode, leaving the rest of the powder in the hole, or will simply set fire to the main body of powder.

Place a long row of sticks of 40% gelatin dynamite end to end. Use 25 or 30 of them. Place an ordinary cap, say a Gold Medal (No. 4) in one end cartridge, pointed toward the string of powder. It depends upon the amount of paper between the cartridges, how closely in contact the powder is as to just how many of them will explode. It is safe to say that not more than half of them. Use a No. 6 cap and the detonation will carry farther. A No. 7 or a stronger cap will carry the detonating wave in proportion to its strength.

This means that a complete explosion of the powder is obtained only a limited distance from the initial point of detonation and that the greatest power is developed by the primer cartridge itself. Even though all the powder in a hole loaded to the muzzle may explode, the cartridge farthest from the cap exerts the least force. Not only this, but the primer is the first to explode, and in a long column this fact may make a material difference in some ground.

Detonation is a peculiar but now well known phenomenon and to go into the reasons *why* the primer cartridge exerts the most force and therefore should be placed where most needed, would take up too much space. It is nevertheless a fact, that when the primer is not placed near the bottom, the reason that the hole breaks at all is because the burden is so light that a complete explosion (the greatest force possible) is not necessary.

The fact that fuse running alongside of and in contact with powder is likely to set fire to it, even gelatin, cannot be gainsaid. This is the cause, to a considerable extent, of the excessive amount of smoke and nauseous gases given by the explosion of a round of holes loaded with nitroglycerine explosives. It is not the gas generated by the explosion but the volatilized unexploded nitroglycerine that causes the well known "powder headache." The question, then, resolves itself into: If you place the primer last you are not likely to get a complete explosion. If you place the primer in the bottom you are apt to burn the powder. And it is impracticable to place the primer any other place than in or near the bottom in a round of machine holes, in a mine drift or medium-sized tunnel, because of the fact that one hole will almost invariably cut off part of one or more of the others.

My experience in eight states and in more than 50 different mines compels the conclusion that there are few instances where it is at all safe to load a machine round with the primer last. In conclusion it may be well to state that if it were not for the presence of moisture in the holes from the water used in drilling, which, together with the paper covering, protects the powder from being ignited by the fuse, there would be a great many more burned holes, and it would have been necessary long ago to find different methods of drilling or loading, if not to invent an explosive that would not burn, or a fireproof fuse.

C. B. HANSON,
Field Engineer, Pennsylvania Trojan Powder Co.

Allentown, Penn. Apr. 27, 1912.

Research in Analytical Methods

One is constantly struck with the beautiful results ordinarily reported in researches in analytical methods. It seems to make scarcely any difference how poor the method proves to be when applied in actual work, the original research usually shows 1.000 gram taken, and 0.999973 gram recovered, or similar figures.

Do many of the inventors of methods have the courage to ask fellow chemists or students to weigh out quantities of the element worked on, for them, the exact quantities to remain unknown until the analysis is finished, and only rough figures to be furnished them at first? In this way they would approach working conditions.

I fancy, if so, that there would be fewer reports that "the method far exceeds in accuracy any known method," and more to the effect "the method is fine theoretically, but no one can tell the end point"; "the amount of nickel must be approximately known before running this method," "we earnestly recommend this assay method as a short cut where no money is to be paid on the results." I certainly would like to hear from some of the research artists on this.

D. E. N. M.

St. Louis, Mo., Apr. 14, 1912.

Thiogen Process Demonstration

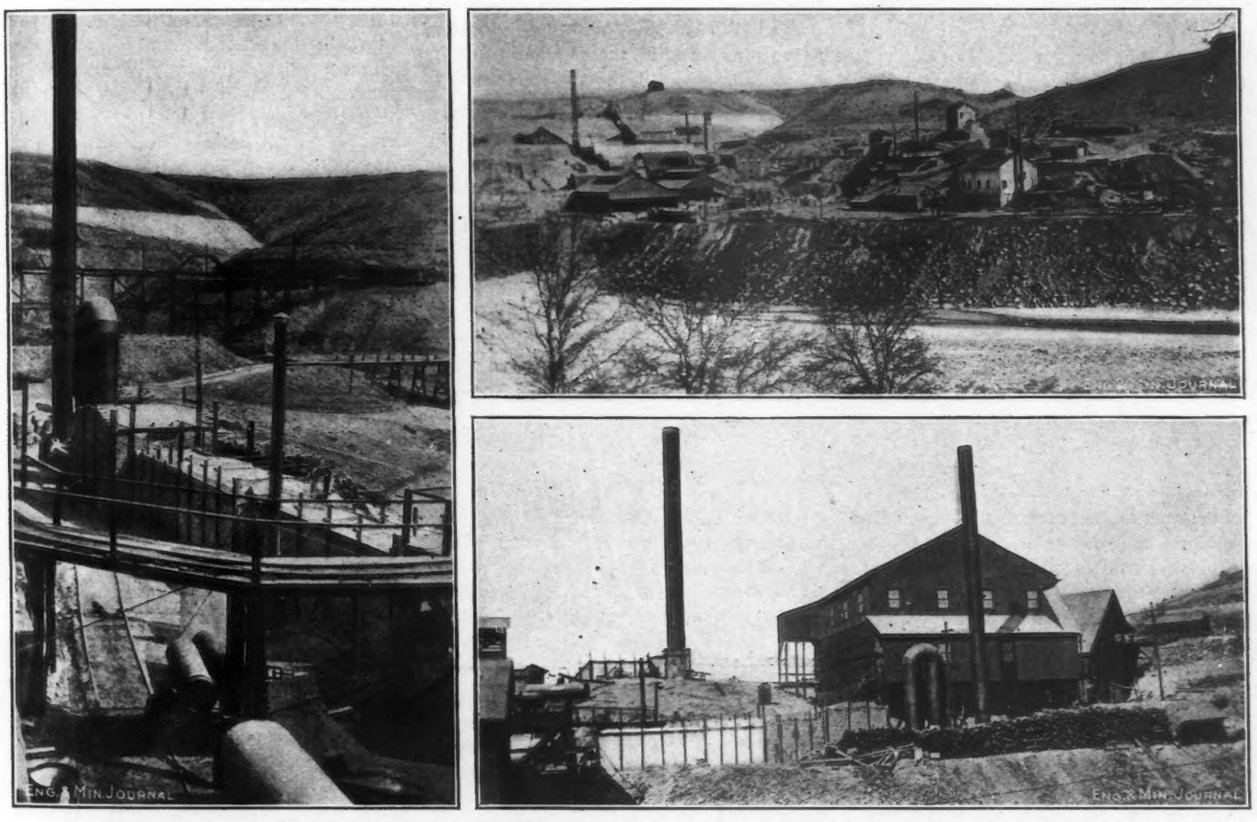
By L. H. Eddy

An application of the thiogen process of reducing to elemental sulphur, by means of hydrocarbons, the sulphur oxides in furnace gases. This is being accomplished in a small plant built for treating McDougal-roaster gases at the Penn smeltery at Campo Seco, California.

The object of the thiogen process, invented by Prof. Stewart W. Young, of Stanford University, is to reduce the oxides of sulphur that are usually present in the gases given off by blast furnaces, reverberatories and roasters, to elemental sulphur in such a condition that most of it can be removed from the furnace gases before they are discharged into the atmosphere.

Satisfactory Results on McDougal Roaster Gases

Satisfactory progress is being made with the process, as applied to the Mc Dougal roasters at the smeltery of the Penn Mining Co., at Campo Seco, Calaveras County, Calif., where the amount of sulphur dioxide in the discharged gases has been reduced to as low as one part in 50,000. The gases from two 11½-ft. McDougal roasters have been treated in the experimental apparatus without forcing its capacity, although some trouble was experienced in obtaining perfect condensation, due to imperfect spraying devices. This seems to be the most important engineering problem remaining to be solved, and the apparatus is being remodeled in order to secure better results from the spray. The construction of the experimental plant is crude, as it was designed primarily for demonstrating the principle of the process and experimenting in order to gather sufficient data for guidance in the construction of a permanent plant.



Thiogen Process Flues and General View, Penn Smeltery, Campo Seco, California

The plant comprises a brick flue 40 ft. long, about 6 ft. high and 7 ft. 4 in. wide, outside measurements; a condensing chamber 10 ft. high and 10 ft. square, and a second flue 10 ft. long, 6 ft. high, 4 ft. wide, extending to and connected with a smokestack 3x3x65 ft. high. The 40-ft. flue, into which the gases pass direct from the roasters, is provided with transverse panels, as shown in the accompanying sketches; these panels are of brick checkerwork 4½ ft. high, 4½ ft. wide, and 9 in. thick. The openings or flues in the checkerwork panels are filled with plaster of paris, to which sawdust has been added; the sawdust burns out, leaving the plaster of paris porous. This is the contact material. It may be cast in any desired shape, thin enough to be readily broken in small pieces and easily disposed in the open spaces in the checkerwork panels. This flue is connected to the roaster by an intake pipe about 2 ft. diameter, and to the condensing chamber by a 2½x2½-ft. outlet through the dividing wall. The condensing chamber is provided with a partition wall, parallel with the checkerwork panels of the flue, 8 ft. high and 9 in. thick. This chamber is connected to the second or after flue by a 2½x2½-ft. outlet through the dividing wall. The second flue is connected to the smoke-stack by a 2x2-ft. outlet.

Sulphur Oxides Reduced by Hydrocarbons

The operation of the plant is as simple as the process is interesting. The whole apparatus having been previously heated to a low red heat, the gases from the roasters are caused to pass through the intake pipe into the fore chamber of the main flue, which may be designated as the contact flue, where they mix with

hydrocarbon vapors from the oil vaporizer inserted through the end wall of the flue just beneath the intake pipe. The gases then pass through the checkerwork panels, which contain the contact material. By the time the gases reach the condensing chamber they no longer contain appreciable quantities of sulphur dioxide or sulphur trioxide, these having been completely reduced to elemental sulphur. From this point the remaining operation consists in condensing the sulphur to solid or liquid form. The partition wall in the condensing chamber forms two compartments, through which the gases must pass; first through the compartment adjoining the contact flue, thence over the partition wall and through the compartment adjoining the second or after flue. The condensing chamber is provided with a water spray, inserted through the roof between the dividing wall of the chamber and the contact flue. Contact with the spray cools the gases below the condensing point of sulphur. The floors of the two compartments of the condensing chamber are inclined toward the center, thus providing drainage for the water.

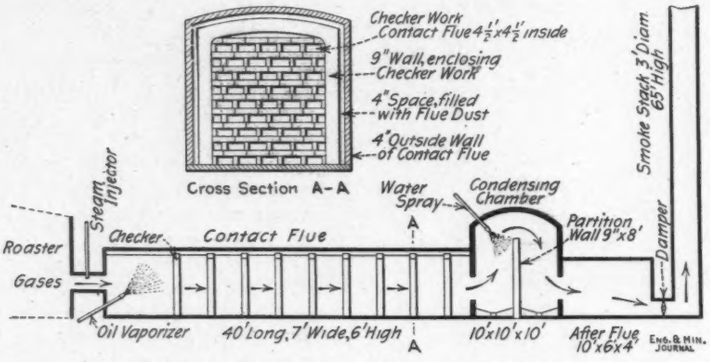


DIAGRAM OF THIOGEN PROCESS PLANT

The first trial indicated satisfactory reduction of the oxides of sulphur, the apparatus, however, worked under a negative pressure, and water soaked through the walls of the flue. To obviate this difficulty, a steam injector was introduced at the intake pipe, and a regulating damper placed in front of the smokestack. By the regulation of these two devices a slight pressure may be maintained in the apparatus. With the apparatus in this condition, the excellent results referred to were obtained. Sulphur has been obtained from traps in the condensing chamber in the form of rubber-like clots, and as milky sulphur emulsion with the excess water. It has also been condensed on iron pipes placed within the apparatus, and when so obtained is quite pure and crystallizes readily as the characteristic yellow sulphur. Considerable quantities have been carried by the draft out of the smokestack in the form of finely divided flowers of sulphur; quantities of this have also been collected.

BRICK WALLS MAY BE SUBSTITUTED FOR CHECKERWORK

The experimental stages of the process are almost completed, and it will soon be possible to proceed with more pretentious construction. Since my visit to the plant, Apr. 9, 1912, the engineers have made an experiment which may result in the substitution of solid brick baffles in the place of the checkerwork panels, although this has not yet been definitely decided. In the construction of the checkerwork panels, the faces of the structure are coated with plaster of paris, so that the contact is complete. It has been found that some flue dust accumulates in the after end of the contact flue. By the use of baffles coated with plaster of paris, the accumulation of flue dust descends to the bottom of the contact flue and may be more easily disposed of, but this is a detail of construction that affects the economy of operation and not the scientific principle upon which the operation is based. Another modification being considered by the engineers, relates to the character of the material used in the construction. Concrete and steel may be substituted for brick. In fact, there are various details to be considered in the construction of a permanent plant that could not have been clearly foreseen, except through the operation of the experimental plant.

The patents of the process are controlled by the Thiogen Co., a Delaware corporation, of which Charles R. Miller, of Wilmington, is president. H. G. McMahon, of San Francisco, is vice-president, and John T. Overbury, of San Francisco, is secretary and treasurer. These men, with Prof. Young and Hamilton Sanborne, are the owners of the patents. A. M. Hunt, of San Francisco, is consulting engineer, and Donald E. Fogg, formerly of the Peyton Chemical Co., is chief engineer.

According to the *Electrical World*, recent work at the University of Wisconsin resulted in determining the melting point of tungsten as 3002° C., and of tantalum as 2798° Centigrade.

John Fritz

In view of recent reports of his serious illness, the friends—and this means everyone—of John Fritz will be glad to learn that his condition has decidedly improved recently and that there is a fair prospect of his recovery. Probably the strongest elements counting for success in the struggle that our grand old friend has had, and is having, with sickness, are his indomitable nerve and pluck, and the great constitution with which nature endowed him, and which has been conserved by a temperate, well ordered life.

About two months ago his medical attendants found that it would be necessary to open a gathering on his chest which had been giving him much pain, and later, quite recently, on April 15, it was found essential to follow this with a much more serious operation for the removal of pus from gatherings that had formed on his breast and side. In his weakened condition Mr. Fritz naturally shrank from pain; at the first operation this was avoided by freezing the locality to be operated on. When Mr. Fritz heard the hissing of the jet used, he opened his eyes as he lay in bed, and turning to a friend by his bedside said: "That sound reminds me of my first Bessemer blow."

After the operation the surgeon said to him, "Now, Mr. Fritz, I'm going to tell you what I wouldn't have told you if you had refused to have the gathering opened. I was afraid that if we didn't open and drain it, the inner wall of the sac might prove weaker than the outer, and that it might break inward and do you serious injury." Mr. Fritz lay still for a few moments. Remember this was after quite a severe operation for a man in his weakened state—and then turning to the same friend, said: "That reminds me of Muggins. One time, years ago, a steamer blew up when lying at the Battery wharf in New York, and all the New York papers and local wiseacres spent weeks in speculating on the cause of the blow-up. Finally Muggins spoke up and said that it was his opinion that the boiler exploded because the inside pressure was greater than the outside pressure."

At the time of the second, or more severe, operation about two weeks ago, the same friend was by Mr. Fritz' bedside, and in urging him to have it performed said: "Remember, Mr. Fritz, the doctors are going to use laughing-gas (nitrous oxide) as an anesthetic, and you've often taken that when you've had teeth pulled, and you know that it will save you all suffering," "That's all right," Mr. Fritz replied, "but they shan't take out any of my teeth"—the joke being that he hasn't a tooth of his own left. Again being joked, at the time he was preparing for the operation, on his pretending to be ill, when only the day before he had sent out and bought a new horse, and had been taken to the window to see the

horse go past, he said: "Yes, I paid $225 for that horse and I'm going to sell him after a while for $400. You see if I don't."

When a man of 90—his ninetieth birthday comes in August next—can joke thus when prostrate with illness, surely we may share the surgeon's confidence that one with a mental attitude such as these stories indicate, may well recover from his present prostration, and that the engineering profession may look forward to paying its tribute of loving respect to dear old Uncle John Fritz on his coming ninetieth birthday.

Loving friends are about him, and old friends are anxiously watching for his recovery. The above tidings come to us following a visit of Doctor Raymond's to Lehigh University, and a call on Mr. Fritz, on April 28, by Doctor Raymond and Doctor Drinker.

Chino Copper Co.

The report of the Chino Copper Co., operating mines at Santa Rita and a mill at Hurley, N. M., covers the period of 19 months ending Dec. 31, 1911. True operating was carried on in the last quarter of the year, during which 986,375 lb. of copper were produced, which sold at 13.3c. per lb. The expense of production per pound of copper was: Mining, 0.774c.; freight on ore, 0.461; milling, 5.391; treatment, refining and freight, 3.175; selling commission, 0.133; total, 9.934c. per pound.

Ore reserves on Dec. 31, 1911, are given as 55,000,000 tons, containing 2.24% of copper. It is estimated that of this amount, 32,000,000 tons can be mined by steam shovel, based on mining by this means to a depth of not over 200 ft. As it may be possible to mine by opencut to greater depths, this tonnage may be exceeded.

At Santa Rita, 2803 acres are held by the company, containing everything likely to be of value, or needed either for mining or surface uses. At Hurley, 7158 acres are held for mill site and water rights. The first section of the mill was started on Oct. 16, 1911, about 15 months after beginning construction work, the second about the end of December, the third on Apr. 1, 1912, and it is estimated the other two will both be running before Sept. 1, 1912. To date, $2,234,993 has been spent on account of the new mill.

Up to the end of 1911, about 2,000,000 cu.yd. of material had been removed, of which 1,700,000 was waste, the remainder was partly oxidized ore, most of which was stored, the remainder going to the concentrator, where a recovery of about 22 lb. of copper per ton of ore gave the production and costs mentioned above. The concentrates are sent to the smeltery, at El Paso.

April Mining Dividends

As compared with April, 1911, the mining dividends reported for April, 1912, are decidedly encouraging. United States mining companies paid $7,045,270, as compared with last year's $6,048,280; metallurgical and holding companies $3,656,358, as against $3,199,644 in 1911; and Canadian and Mexican companies $1,515,211, against $1,669,122 a year ago. The falling off in the last is, of course, accounted for by the troubles in Mexico. For instance, the Mines Co. of America, although it had a successful year and first quarter, considered it wise to take no present action on dividends, and San Toy failed to appear in this month's list. Among Canadian companies, the Standard Silver-Lead Mining Co. appears for the first time.

United States Mining Companies	Situation	Per Share	Total
Ahmeek	Mich.	$4.00	$200,000
Am. Zinc, Lead & S.	U. S.	0.50	40,060
Anaconda, c.	Mont.	0.50	2,119,000
Ariz. Cop., pf. A.	Ariz.	0.047	5,769
Bunker Hill Con., g.	Calif.	0.07½	15,000
Bunker Hill & Sull., l.s.	Ida.	0.15	49,050
Cente'ial-Eureka, l.s.g.	Utah	1.50	150,000
Copper Range, c.	Mich.	0.50	192,093
Champion, c.	Mich.	1.00	100,000
Daly-Judge, s.l.	Utah	0.15	45,000
Daly-West, s.l.	Utah	0.30	54,000
Elkton, g.	Colo.	0.01½	37,500
El Paso, g.	Colo.	0.01	24,500
Frontier, z.	Wis.	2.00	2,500
Golden Cycle, g.	Colo.	0.02	30,000
Goldfield Con., g.s.	Nev.	0.50	1,779,574
Hecla, l.s.	Ida.	0.02	20,000
Homestake, g.	S.D.	0.50	109,200
Iron Blossom, s.l.g.	Utah	0.10	100,000
Mary McKinney, g.	Colo.	0.02	26,185
New Idria, g.	Calif.	0.30	30,000
North Butte, c.	Mich.	0.40	164,000
Old Dom'ion M. & S., c	Ariz.	1.00	162,000
Opohongo, g.s.l.	Utah	0.01	26,969
Pittsburg-Idaho, l.	I a.	0.04	32,120
Portland, g.	Colo.	0.02	60,000
Stratton's Ind., g.	Colo.	0.06	60,750
Tonopah-Belmont, g.s.	Nev.	0.25	375,000
Tonopah-Mining, g.s.	Nev.	0.40	400,000
United Globe, c.	Ariz.	3.00	69,000
United Verde, c.	Ariz.	0.75	225,000
Wolverine, c.	Mich.	5.00	300,000
Vindicator, g.	Colo.	0.03	45,000
Wasp No. 2, g.	S. D.	0.01	5,000

Coal, Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Ag. Chem., pfd.	U. S.	$1.50	275,730
Am. Ag. Chem., com.	U. S.	1.00	171,141
Am Sm. Sec., pfd. A.	U. S.	1.50	255,000
Am. Sm. Sec., pfd. B.	Mex.	1.25	375,000
Central C. & C., com.	Mo.	1.50	76,875
Central C. & C., pfd.	Mo.	1.25	23,437
Consol. Coal	Md.	1.50	299,148
Guggenheim Expl.	U. S.-Mex.	2.50	519,832
General Chem., pfd.	U. S.	1.50	150,000
Inter. S'm'k. Pow.,com.	Del.	0.50	90,000
Inter. S'm'k. Pow., pfd.	Del.	2.00	24,000
Island Creek Coal, pfd.	U. S.	1.50	75,000
Harbison Walker, pfd.	U. S.	1.50	144,000
National Carbon, com.	U. S.	1.50	82,500
Old Dominion, c.	Ariz.	0.75	219,933
Pittsburg Coal, pfd.	Penn.	1.25	371,262
Sloss-Sheffield, pfd.	Ala.	1.75	117,250
Va.-Car. Chem., pfd.	U. S.	2.00	360,000
Vulcan Detinning, pfd.	N. J.-Ill.	1.75	26,250

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Beaver, s.	Ont.	$0.03	$59,989
Buffalo Mines, s.	Ont.	0.05	50,000
Crown Reserve, s.	Ont.	0.05	88,441
Domin. Coal, com.	N. S.	1.00	150,000
Kerr Lake, s.	Ont.	0.25	
La Rose, s.	Ont.	0.12½	187,300
McKinley-Darragh., s.	Ont.	0.10	224,769
Nipissing, s.	Ont.	0.37½	450,000
Nova Scotia S&C., com.	N. S.	1.50	90,000
Nova Scotia S & C. pfd.	N. S.	2.00	20,600
Standard Silver-Lead.	B. C.	0.01½	25,000
Tem. & Hud. Bay, s.	Ont.	3.00	23,283
Temiskaming, s.	Ont.	0.03	75,000
Wettlaufer-Lorrain, s.	Ont.	0.05	70,829

The rising price of copper for the last few months was reflected in the increased dividends of Ahmeek and Wolverine, both of which raised their rates $1, and in North Butte, which raised its rate from 30 to 40c. Anaconda's rate, for the present, remains unchanged.

The Cripple Creek district of Colorado made a good showing, as Elkton, El Paso, Golden Cycle, Stratton's Independence, Mary McKinney, Portland and Vindicator all contributed, paying $283,935, although premier honors among the gold-mining companies must go to Goldfield Consolidated, of Nevada, with its $1,779,574 quarterly disbursement. Nevada also can claim Tonopah-Belmont and Tonopah Mining with $775,000 for the same period.

United States mining companies making public reports, have paid $20,784,290 in dividends in the first four months of 1912. Mining, metallurgical and allied companies in North America report $54,998,011 for the same period. Judging by these figures, the "paralysis" of the mining industry so often heard of is of a singularly mild type.

Chronology of Mining

Apr. 1—Miners in Butte decided not to strike by vote of 4460 to 1121, an emphatic defeat of the radical element.—A gold bar of 160 oz. was deposited from the McIntyre mill in a Porcupine bank, being the first commercial product from the Porcupine district.—Miami Copper Co. declared initial dividend.—Inauguration of anthracite coal miners' strike in the United States.—Flume of the Wanapitae Power Co. at Sudbury, Ont., burst, depriving several nickel mines of power.

Apr. 2—Stockholders of Chino Copper Co., voted to increase capital stock by 100,000 shares.

Apr. 6—Leaders instructed the striking British coal miners to return to work.

Apr. 9—Announcement that the Guggenheim interests had acquired property in the Miami district in Arizona.

Apr. 10—Sampling plant of the Nipissing company destroyed by fire.

Apr. 18—Trouble at the Lena Goldfields workings at Irkutsk, Russia, resulted in the killing of 107 and injuring of 80 workmen by troops.

Apr. 21—An explosion of gas in the Coil coal mine at Madisonville, Ky., killed five men, all that were in the mine.

Apr. 23—Witherbee-Sherman dams at Witherbee, N. Y. washed out, entailing $45,000 loss.

Apr. 25—John D. Ryan, president of the Amalgamated company, announced that the company would spend $2,500,000 on reconstruction of the Great Falls smeltery.

Apr. 30—An explosion reported to have entombed 283 miners in the Hokkaido Coal Co.'s mine at Yubari, Japan.

Edgar J. Meyer

Edgar J. Meyer was born Jan. 13, 1884, at San Francisco, and after a preliminary education in that city came to New York, where he continued his schooling preparatory to entering Cornell University. At Cornell, he spent a year in the Academic Department, followed by four years in the School of Engineering, and received the degree of M.E. from that institution in 1905. He was a member of the Zeta Psi fraternity. In addition to his regular course, he was keenly interested in research work and made a particular study of gas engines. The result of his work in this direction brought him particular praise, and some of the theories he evolved in reference to the velocity of flame propagation of explosive mixtures were incorporated in the works prescribed in engineering courses.

After graduating from Cornell with honorable mention, Mr. Meyer entered the employ of the banking firm of Eugene Meyer, Jr. & Co., of New York, in which firm he subsequently became a partner to his brother who is the senior member. This firm has been and still is represented on the boards of certain of the largest mining enterprises both here and abroad. These interests required Mr. Meyer to spend considerable time in the field. At the time of his death he was vice-president and director of the Braden Copper Co. and was also active as an official of numerous other important corporations.

In the business and mining world, Mr. Meyer will be remembered as a close and careful student of values. He applied his scientific training with a great degree of sagacity to the consideration of problems of the mining industry as well as finance in general, and his combined ability as an engineer and business man was rapidly bringing him to the front. Mr. Meyer had especially close knowledge of the steel and copper business. The statistical study and analysis which he made in 1909 of the development and operation of the United States Steel Corporation, created much favorable comment. His conclusions in regard to the position of copper, drawn after a personal investigation in the important copper centers, were accepted as carrying much weight by those most vitally interested in the business, though at the time of his death he was but 28 years of age. Aside from his duties as an active member of a banking firm, he found time to interest himself in various other channels, having patented several automobile appliances and being also a member of the Technical Committee of the Aëro Club.

He met his death in the "Titanic" disaster, and in this catastrophe he distinguished himself in his endeavor to save the lives of others. According to the accounts of survivors, Mr. Meyer, after seeing his wife safe into one of the boats, remained and helped lower the last boat of women and children that left the ship. Mr. Meyer was married in 1910 to Miss Leila Saks, daughter of the late Andrew Saks, who, with a little girl of one year, survives him.

March Operations at Goldfield Consolidated

During March, the total production of the Goldfield Consolidated Mines Co. was 30,132 tons, containing $734,655, an average of $24.38 per ton; this was milled with an average extraction of $22.92 per ton, or 93.99%. The total net realization was $491,337, or $16.31 per ton. Development work totaled 2719 ft. for the month.

MARCH OPERATING COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$0.80	
Stoping	2.55	
		$3.35
Transportation		0.08
Milling		2.11
Marketing		0.11
General expenses		0.49
Bullion tax		0.19
Construction		0.33
Total cost of operation		6.66
Miscellaneous earnings		0.05
Net cost per ton		$6.61

At the Clermont, the sill of the 428 stope between the third and fourth levels was extended and produced 53 tons of $26.45 ore. The 604 raise from the 1000-ft. level, and the stope being opened from the raise, produced 916 tons, averaging $56.34 per ton. The 700-M stope between the 1000- and the 1200-ft. levels produced 63 tons, averaging $45.47 per ton. At the Mohawk, the 111-M sill produced 524 tons of $15 ore. The 212-X crosscut, on the 350-ft. level, produced 53 tons, averaging $69.52 per ton. The 208-X intermediate, under the 111 sill, produced 30 tons, averaging $48.60 per ton. The 354 sill was extended and produced 198 tons of $74.40 ore. The 491 sill, under the old Mohawk-Jumbo lease workings, produced 436 tons of $17 ore.

At the Red Top, the 353 intermediate, between the second and third levels, was extended in ore and produced 151 tons, averaging $32.50 per ton. The 216-N raise from the second level produced 130 tons of $63 ore. The vertical raise from the 750-ft. level of the Hazel has holed to the bottom of the Laguna shaft, and is being squared out and the shaft timbered down to the bottom. The Hazel shaft surface plant will be dismantled, and all deeper development in this territory prosecuted through the Laguna shaft. In the Combination mine, superintendent Thorn states that an important discovery has been made between the fourth and fifth levels, in the Riley vein, about 300 ft. southeast of the shaft. The 311-P raise, from the fifth to the fourth level, produced 140 tons of ore, averaging $86.60 per ton. The upward extension of this orebody was cut in an intermediate between the second and third levels, where two hanging-wall crosscuts, 60 ft. apart, exposed 7 ft. of ore, which averaged $250 per ton. The 292-O sill was extended and produced 69 tons, averaging $25.60 per ton. The 328 sill produced 41 tons, averaging $20 per ton.

Horace J. Stevens

Horace Jared Stevens, whose death at Houghton, Mich., April 22, was briefly noted last week, was born in 1866, at Cattaraugus N. Y. He was educated in the common schools of his native town, where his father was, and is, a farmer. He taught school in his youth and at about the age of 18 went to Lake Superior, to Ishpeming, where his uncle, H. Olin Young, was engaged in the practice of the law. He found work at first in the mines and for five years was employed in various capacities at the old Beaufort mine. In 1889 he became a reporter in Ishpeming for the Marquette *Mining Journal*. While engaged in practical newspaper work he established in Ishpeming the Peninsula News Bureau, for the dissemination of mining and general news. About 1890 he removed to Houghton, where he continued in newspaper and correspondence work. For several years prior to 1900 he was assistant to the state commissioner of mineral statistics. In 1901 this work led him to begin the publication of his "Copper Handbook," which he enlarged from year to year and by which he became widely known. He was an extremely hard worker and prepared the successive volumes of the "Handbook" with very little assistance. He was one of the best known men in the copper country, and had a wide acquaintance among mining men everywhere. He leaves a widow and two children, one of them a student at the Michigan College of Mines.

Witherbee-Sherman Dams Burst

Press dispatches detailed the washing out, on Apr. 23, of three dams of the Witherbee-Sherman Co., at Witherbee, N. Y. These reports were largely exaggerated, the facts being substantially as follows: Due to severe winter and spring conditions, it is believed that water got under the concrete dam, built by the company about two years ago to create an artificial reservoir about a half mile long and several hundred yards wide. This dam went out, taking with it two smaller ones, and several bridges. The damage done to inhabitants' houses was slight or negligible, and no lives were lost. One

of the company's power houses was partially flooded. The financial loss to the company amounted to about $45,000, and operations were suspended for 48 hours. The chief loss was that of about 1500 tons of coal, which is difficult and costly to bring to the property; this was washed away by the flood. The concrete dam was constructed to insure a constant supply of water for the compressors and it is stated that the company will probably be somewhat cramped for water this summer.

Miami Copper Company

GLOBE CORRESPONDENCE

J. Parke Channing, vice-president and consulting engineer of the Miami Copper Co., is making a visit of inspection to the mine and speaks optimistically of its future.

"The 570-ft. level is looking remarkably good, the ore being opened by the development work now in progress containing fully as much copper per ton as the average for the orebody. I have never estimated more than 50 ft. of ore below this level, but I am confident that it will extend much deeper, and in time a crosscut will be driven from the main shaft on the 720-ft. level.

"Unexpected ore is being disclosed on the 420-ft. or present extraction level. It has been determined that on all the levels above, the orebody is limited on the north by an approximately east and west fault, but on the 420-ft. level a drift north through this fault has passed through clean ore for a distance of 100 feet.

"Seven shrinkage stopes are in different stages of operation above the 420-ft. level. One is completed and is full of broken ore; mining is being done in three, and three others are in the preparatory stage. After the stopes are finished and filled with broken ore, the pillars will be removed by top slicing, at the same time the ore will be drawn from the stopes so that the capping may settle evenly. Conditions may arise that will permit modifications of this method, such as blasting and weakening the pillars so that they will be crushed and then the ore from the stopes and pillars will be drawn together.

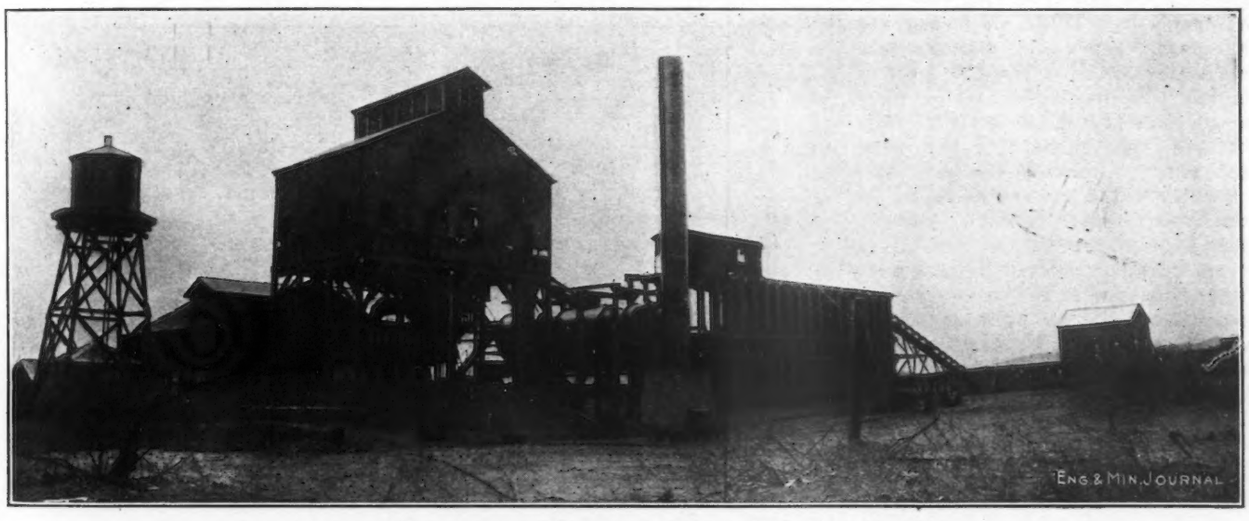
"The cost of mining for last year, as shown in the company's annual report, was $1.21 per ton. It might have been 40c. less if it had been the desire to mine wastefully and without regard to the safety of the men. The excessive cost was due to the large amount of square setting and top slicing done around the top and sides of the orebody for the purpose of forming a mat of timber between the capping and the ore. From many years' experience in similar large ore deposits, I can say unhesitatingly that it is absolutely impossible to mine the ore clean and with safety to the miners without placing a timber mat between the ore and the capping.

"Copper is being produced at the rate of a little less than 3,000,000 lb. per month, but it is hoped soon to bring production up to that figure. Excellent results are being obtained with the Deister tables in the mill, but some changes will be made in the crushing machinery. The Hardinge pebble mills have been demonstrated superior to chilean mills for fine grinding and probably will eventually replace them in all units. It is also probable that the rigid rolls used for the intermediate crushing will be gradually replaced in all units by heavy spring-rolls. The Traylor Engineering & Manufacturing Co. is building an unusually heavy set of spring rolls for use in the mill. They will be of the same size as the spring and rigid rolls now in use, 16x42 in., but the frame will be more massive and the construction throughout heavier. Seven Crocker-Wheeler 150-hp. motors have been ordered to replace the 100-hp. motors now used in driving the rolls. Hardinge ball mills have been tried, but have not thus far proved equal to rolls; the consumption of steel is apparently greater than with the rolls.

The Pioneer Smeltery, Arizona

BY A. L. WATERS*

The new smeltery of the Pioneer Smelting Co. will be blown in about May 1, 1912. It is situated at Corwin, Pima County, on the Twin Buttes railroad spur, 1½ miles west of Sahuarita station and 20 miles south of Tucson, Ariz. It is a custom plant at which ores from the Twin Buttes, Mineral Hill, Helvetia, Tip Top and many of the smaller mines of the district will be smelted. These ores are low grade, containing from 3 to 4½% copper with iron or garnet gangue and for the most part are nearly self fluxing. None of the ore from any one property is entirely self fluxing, nor does any contain enough copper to be profitably shipped out of the district.



GENERAL VIEW OF THE PIONEER SMELTERY, NEAR TUCSON, ARIZ.

The Pioneer company owns the Plumed Knight mine adjoining the Mineral Hill property. It has been opened to a depth of 335 ft. The last 1000 tons shipped to the smeltery assayed: 20c. gold and 1.3 oz. silver per ton, 4.25% copper, 2.5% sulphur, 16.8% iron, 15% lime, 34.24% silica. From this mine 40 tons per day is being shipped to the smeltery, and the Twin Buttes company is shipping 50 tons per day; the ore contains silver and copper, is rich in iron and poor in silica. The Morning Glory mine at Patagonia is shipping 10 tons per day of ore containing 2 oz. silver, 2% copper, 43% sulphur,

*Managing director, Pioneer Smelting Co., Tucson, Ariz.

40% iron and 10% silica. The Gould mine, 12 miles west of Tucson, is controlled by the Pioneer company and is now being unwatered and prepared to ship 30 tons of ore per day which, judged by the production of 1907, is expected to contain 1 oz. silver, 3% copper, 20% sulphur, 24% iron, 14% lime and 23% silica.

Ore Hauled in Motor Trucks

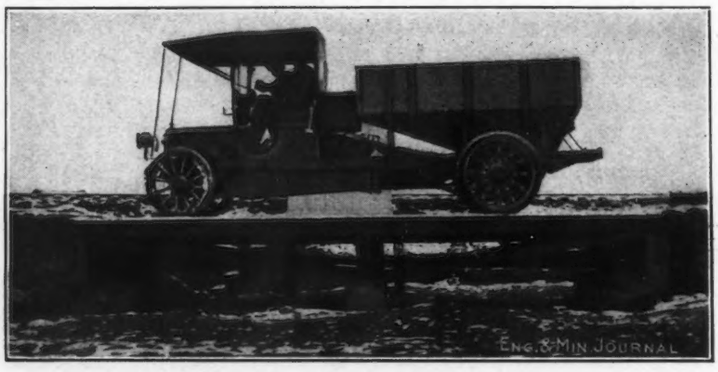
The various mines are several miles from the railroad. The country is gently sloping tableland, running down from the foothills where the ores are found, to the center of the valleys where are the railroads. Several motor trucks have been tried in the vicinity of Tucson and all have been commercial failures. In spite of these discouraging examples, the management considered that the conditions under which the Pioneer plant was to be operated were more suitable and a 6½-ton capacity Saurer truck was acquired to haul ore from the Plumed Knight mine to the smeltery; the distance is 7.7 miles with a fall of 600 ft. There are two hills against the load coming down. Each hill is 300 ft. long and 8% grade. For a long distance there is a steady 3% down grade in favor of the load. The road packs hard and there are no rocks in it to cut the tires. Several small sand washes have been filled with soil that packs well. The truck makes the round trip in two hours; 20 minutes is required for loading and unloading. It travels 94 miles, or makes six trips per day, with two shifts of drivers and uses 18 to 20 gal. of gasoline costing 22c. and 1 gal. of oil at 56c. per gal. The rubber tires traveled 6000 miles and are believed to be good for 2000 miles more. The total cost, including 15% depreciation, interest on investment, insurance, repairs and replacements is 75c. per ton moved. The cost with teams would be from $1.50 to $2 per ton.

Ores are brought in by railroad, truck or teams and weighed on "Strait" scales, all parts of which are above ground and are easily accessible for inspection of the working parts. The ore is unloaded on a trestle 8 ft. above the level of the ground and $^{1}/_{10}$ is taken in wheelbarrows to storage sample-bins. From these bins it is taken to the mill by a belt conveyor. The mill is small and simple, consisting of a 7x11-in., Dodge crusher, one elevator, a Vezin automatic sampler which delivers to 16x20-in. rolls; the last discharge the sample upon the coning plates where the final cutting down is done by hand and the final pulp is ground by a Braun disk sample-grinder.

The plant is built on ground that has a general grade of 1 ft. per 100 and drops off 4 ft. per 100 directly in front of the blast furnace. Preliminary plans were drawn for a plant of 1500 tons daily capacity, including reverberatories and converters, and arranged so that the plant could be enlarged. The ores are bedded under the trestles and along the sides of the embankment and are also delivered by belt conveyor to the first unit of six bins, capable of bolding 4000 tons of ore. After the ore mixture is made up, it is dumped into a hopper and when wanted is sent to the feed floor on a belt conveyor which discharges into a bin from which the furnace charge is fed through a swinging iron spout. By this method of feeding all the fine material is thrown to one side of the furnace, a distribution which has been found to be necessary in the type of furnace used.

Oil Engines Used

The prime movers are two 90-hp. De La Vergne crude-oil engines. While there is nothing novel about this type of power, it was looked upon with great suspicion by local mining men and is believed to be introduced for the first time at a copper smeltery. These engines drive the blowers, compressor, deep-well pump and the 55-kw. generator, which furnishes power for the sampling mill, belt conveyor, and lights. The engines are operating smoothly on 20° California crude oil with asphalt base. The oil costs $1.47 per bbl. of 42 gal. laid down at the engines. The engines are guaranteed to deliver one brake horsepower hour on 0.6 lb. of this oil and in preliminary tests delivered that power on 0.44 lb. The management estimates that these engines will be more economical by $47 per day than an oil-burning steam power plant of equal size; $40 for difference in cost of fuel and $7 for firemen and incidentals.



Saurer Truck Used at Pioneer Smeltery

Crude Oil Used in Blast Furnace

The blast furnace was designed and built by the Colorado Iron Works Co. and is an application of the principles patented by the late John W. Nesmith, the founder and for many years the president of that company. The furnace is 106x42 in. at the tuyeres and is a modern, small, copper-matting, blast furnace except that a part of one side is removed and a crude-oil burning-chamber is attached. California crude oil will be used as smelting fuel except when the sulphur in the charge is sufficient to permit turning blast into the one set of tuyeres on one side of the furnace to aid in burning the hot sulphide ore. The combustion chamber really becomes a large hot-blast tuyere where oil is completely burned and driven into and through the column of ore in the furnace. Complete combustion before striking the ore prevents the formation of lampblack which would mix with the half-fused charge and make an infusible mass of balls which has stopped the career of many an experiment in blast-furnace smelting with oil. A 42-in. hexagonal oil-burning furnace was built and operated for many weeks in the yards of the Colorado Iron Works Co. and more than 900 tons of ores containing high percentages of magnetic iron and also alumina were successfully smelted in the furnace and the matte sold to the Golden smeltery. The first three weeks of those tests witnessed repeated freeze-ups and discouraging difficulties; during the succeeding two weeks less trouble was experienced and during the last two weeks the furnace ran smoother than an ordinary coke-burning furnace.

California Oil in March

The net production of petroleum in all California fields in March was 6,923,908 bbl. In February, the total net production was 6,542,682 bbl., an increase for March of 381,226 in total production, but a decrease in daily average production from 225,609 for February to 223,352 for March. The shipments for March were 6,030,906 bbl.; a decline of 3128 in the total, and a decrease in the daily average of 13,528 bbl. Field consumption in March in all fields was 443,089 bbl. The stocks on hand at the end of March amounted to about 43,000,000 bbl., an increase over February of 900,000 barrels.

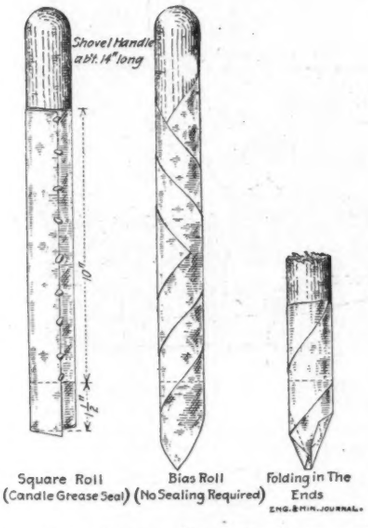
The record of field development showed 34 new rigs, 73 completed wells, 5464 active producing wells, 820 producing wells idle, 435 active drilling, 366 idle drilling, 21 abandoned.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Cartridges for Tamping Dynamite

The importance of tamping dynamite in drill holes, especially the lower grades, is rapidly becoming recognized in the mining practice of the United States. In many instances the powder companies furnish paper cartridges at small cost for incasing the tamping, and in some mines such casings are used. This, however, is not common practice. It has been stated that at one time there was a company, in the Joplin district, that made a practice of supplying the mines with cartridges filled with tamping.



METHOD OF MAKING TAMPING CARTRIDGES

The general practice in the United States is to use fine material from the vein for tamping. This is far better than using no tamping at all, but the sharp pieces of rock that such material usually contains are liable to cut the fuse. In the copper mines of Lake Superior, the miners engaged in drilling and breaking work by contract and pay for the powder they use. They have an excellent method of making tamping cartridges. The tamping is clay sent down from surface that is moistened and mixed with fines from the lode, so that the mass is coherent when tightly packed.

The casing is made from ordinary newspaper, according to two methods, in one of which the newspaper is sealed with candle grease, while in the other no sealing is used. By either method a good cartridge is obtained, but the better method is that in which the paper of the casing is sealed with candle grease.

In both methods the newspaper, in single thicknesses, is wrapped tightly around a piece of old shovel-handle. When candle grease is used, the paper of the cartridge ends in a straight line running lengthwise with the piece of shovel-handle, about which it has been wrapped five or six times. The outside edge of the paper is sealed by dropping candle grease on it and pressing the paper together while the grease is hot. About 1 or 1½ in. of paper extends below the piece of shovel-handle. This is folded up and sealed back on itself by hammering it on a piece of wood after some candle grease has been dropped on it. The shovel handle is then removed, the cartridge filled with tamping, and the other end sealed in a similar way after the tamping has been compacted by tapping the bottom end of the cartridge lightly on a board. An accompanying drawing shows the method of making the cartridge. A cartridge that is rigid and strong results.

In the other system no candle grease or other sealing substance is used. The cartridge is not quite so strong; yet plenty good enough for the purpose. More paper has to be used, as the piece of newspaper is wrapped about the shovel-handle 8 or 10 times. The piece of newspaper is rolled around the shovel-handle so as to end in a double bias at about the middle of the cartridge. In this way side sealing of the cartridge is avoided. The lower end of the cartridge is sealed by folding the paper back upon itself and hammering it vigorously on a piece of board so as to mat it together. The seal is not good, but the cartridge can be removed, tamping put into it and compacted by tapping the bottom on a board. Then the top end is sealed by folding it in several times on itself and compacting the paper of the end by pounding it against a board, as in the case of the other end. Of course, this tapping and pounding cannot be done very vigorously. Such cartridges are strong enough to stand any ordinary usage in loading holes.

In drifting it is advisable to rig the cross-bar for the drills with the adjustable end always on the same side of the drift, then if the lifter on that side be always exploded last it will clear away the broken ground so that there will be plenty of room for the men to operate the jack-bars.

Corrosion-Resisting Steel

Press reports state that the testing department of the United States Steel Corporation has succeeded in its effort to obtain "an alloy steel that would successfully withstand tests with sulphuric acid, the chief enemy of tubing and sheets." Noncorrosive pipe or even pipe that is more resistant to acid mine waters than the present tubing will be greatly appreciated.

It may be worthy of noting in this connection that other steel companies have been giving this matter attention. The Inland Steel Co. is now putting on the market a grade of steel sheet known as "Vismera," of which the following is given as a typical analysis: Iron, 99.542; copper, 0.200%; manganese, 0.190; total metal alloys, 0.390. Carbon, 0.036; phosphorus, 0.004; sulphur, 0.018; silicon, nil; oxygen, 0.009; hydrogen, 0.001; aluminum, nal; total impurities, 0.068.

This company calls especial attention to the copper and manganese content, also to the low content of oxygen. It has long been known that a small percentage of copper, say, 0.25%, increases the resistance of the steel to corrosion, ordinary steel losing weight about three times as fast under sulphuric-acid test as the cupreous steel.

Strength of a Mine Dam

The total pressure exerted by water on a dam is found by multiplying the wetted area of the face of the dam, expressed in square feet, by 62½, the weight in pounds of one cubic foot of water, and this product by the vertical height of the surface of the water above the center of gravity of the wetted area, says *Coal Age*.

To calculate the required thickness of a dam, let

t = Thickness of dam (in.);
r = Shorter radius of dam (in.);
w = Width of opening or span (in.);
p = Pressure of water at dam (lb. per sq.in.);
S = Compressive strength of material (lb. per sq.in.)

For an arched dam

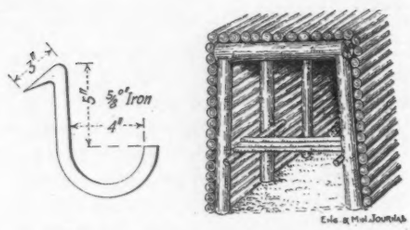
$$t = \frac{p w \sqrt{4r - 1}}{4 S}$$

The shorter radius of the dam should be from ¼ to ⅓ greater than the clear span or width of opening. For practical reasons, it would not be advisable to build a dam less than 20 in. thick.

Staple for Temporary Staging

By B. M. Concklin*

In the accompanying sketch is shown a staple for supporting temporary staging, that is used in the mines of the Oliver Iron Mining Co. on the Mesabi Range.



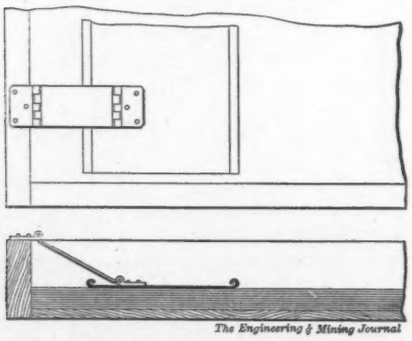
Staging Staple and Manner of Using It

One of these hooks is driven into each of the posts of two adjacent sets and on both sides of the drift. A pole is then laid in the two staples on each side of the drift and across these a platform of lagging is laid as shown in the illustration. The staples can be readily removed with a bar after the staging has served its purpose and has been removed.

Kink for the Blueprint Cabinet

When blueprints that have been much handled and folded are kept in flat drawers in cabinets, the edges are apt to project above the level of the edges of the drawer and become torn when the drawer is opened. Even unused prints are bulky and occupy much space if not weighted down.

The accompanying drawing shows a method of avoiding this trouble, used in the drafting rooms of the Calumet & Hecla Co. At the front end of the drawer a strip of heavy galvanized iron



Hinged Weight for Blueprint Drawer

is fastened to the front of the drawer by three sets of double hinges. This weight is used only at the front end; it effectually prevents tearing the prints when the drawer is opened and holds them compactly in place.

*Mining engineer, Bovey, Minn.

Santa Rita Pressure Box

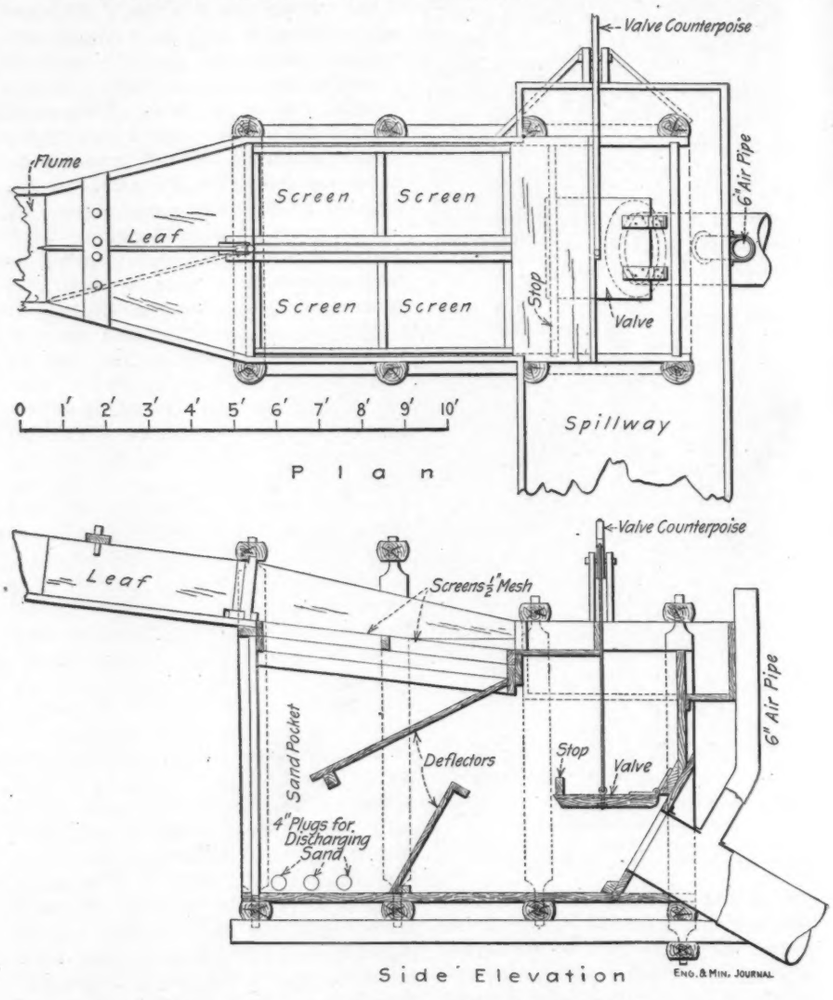
By R. D. O. Johnson*

The pressure box shown in the accompanying illustration was devised by me and is used at the hydro-electric plant of the Santa Rita Mining Co. in the department of Antioquia, Colombia, South America. It is quite satisfactory in operation and so far as I know, there are some unusual features in the design.

Instead of being immersed in the water, as is usual and occupying a vertical or nearly vertical position, the screens are, for the greater part of their length, placed above the water level, and nearly horizontal. As shown in the illustration, the water is delivered to the screens in a direction parallel to their plane. This feature renders the screens much more efficient in as much as sticks, twigs and such elongated pieces of drift and rubbish strike the screens broadside, and are caught. It is my experience with screens placed in a vertical or nearly vertical position and that are submerged, that such rubbish, because of the eddying movement of the water, finally works its way through, unless the screen mesh is very small.

The flat screens are easily cleaned, the accumulated rubbish being raked into the box at the lower end and then in to the spillway. To facilitate this operation the water may be shifted to one side by means of the leaf deflector, or hinged valve board on the apron between the box and the flume. To a certain extent the screens clear themselves automatically. With varying demands for water in the power house, the water level in the pressure box fluctuates. The rising water floats off a part of the accumulated rubbish and carries it out through the spillway.

By means of a deflecting apron made of 1-in. boards and placed under the screens, the direction of the flow of the water is reversed and passes towards the head of the box, thence towards the rear over a sand pocket made by a low, inclined partition running across the box. Three 4-in. holes on each side stopped by wooden plugs serve to discharge the sediment.



Pressure Box for Hydraulic Power Supply Pipe

*Mining engineer, Apartado 110, Medellin, Colombia, S. A.

The mouth of the pipe is provided with a safety valve which in the event of a break in the pipe line, will be automatically closed by the strong current set up thus preventing further ingress of water. The valve is held open by means of a weighted lever.

The weights are so adjusted that the valve will not be closed by the current due to the draft of water in ordinary working. A stop prevents the valve being raised above a horizontal position.

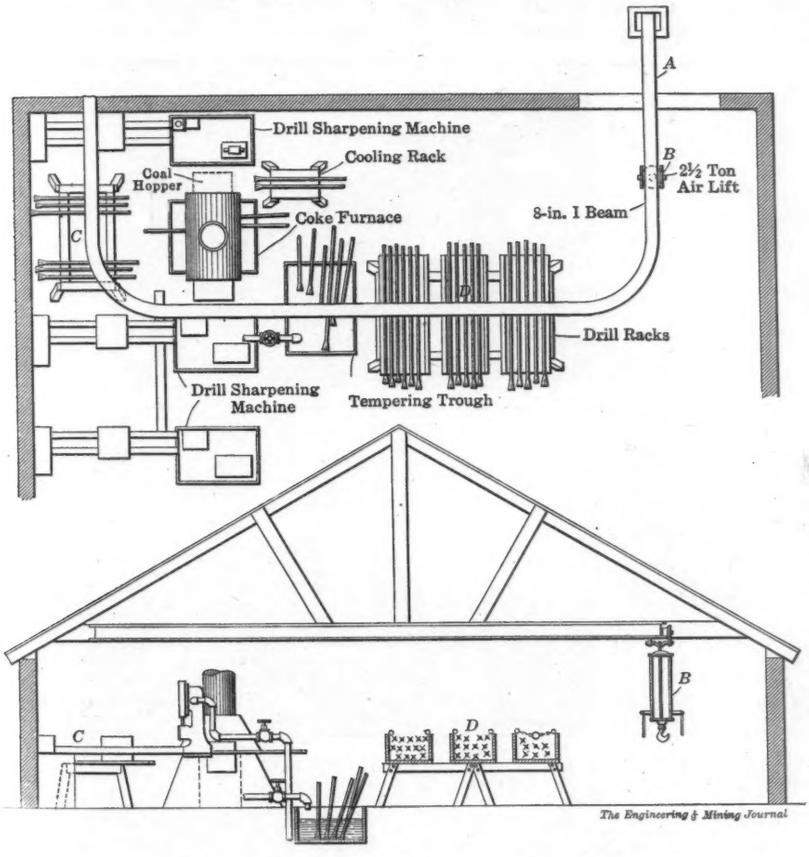
The 6-in. air pipe is a further safety device designed to admit freely a large volume of air upon the closing of the valve and thus to prevent the collapsing of the pressure pipe. The air pipe connects with the pressure pipe below the valve, extends above the water level of the box and is open to the air. The spillway is of sufficient size to carry the full discharge of the flume.

The following formula is recommended by *Power* for cement for steam and water pipes: Paris white, 2 lb.; litharge, 5 lb.; yellow ochre, ¼ lb.; and hemp cut up small, ¼ oz. Mix well with linseed oil to the consistency of putty and use at once. The materials can be mixed dry, and enough for immediate use can be made up with linseed oil. This cement will set under water.

Handling Drill Steel at Champion Mine

The best way of handling drill steel at a mine where there are several working shafts is often a serious question. There are several places at some mines where the steel is sharpened on being brought to the surface. At the larger mines it is generally better to sharpen the steel at some central place. The reason that the smaller mines favor the sharpening of the steel at each shaft is that the cost of gathering the steel is great unless the quantity is large.

This problem of gathering and handling the steel has been solved in a simple manner at the Champion mine of the Copper Range Company in Michigan.



DRILL SHARPENING PLANT AT CHAMPION MINE

At this mine there are four working shafts from each of which steel is gathered. Shaft *B* sends up about 325 drills, shaft *C* 250, shaft *D* 200, and shaft *E* 180 drills per day. The drills are sent up loose on the cages, and at the surface are loaded directly into tank-steel boxes that are carried in the bed of a wagon in summer or sleigh in winter. These boxes are made in three pieces, a bottom and two hinged sides to which rings are fastened for receiving the hoops of the chains used to lift the boxes out of the wagon. While in the wagon the sides of the boxes are held up by the sides of the wagon or sleigh.

In loading these drills they are sorted according to size so that they can be sharpened at the shop without any needless increase in the handling. Each shaft has its own wagon or sleigh. When it has been loaded with dull drills the team which does the hauling for the shafts comes for the wagon in the morning and hauls it to the blacksmith-shop with its load of drills. While the team goes after another load from another shaft, the drills are unloaded by means of an air lift attached to a trolley that travels on an I-beam carried in the frame of the shop.

Picking the boxes up with their load of drills at *A*, in the accompanying sketch by hooking chains into the rings on their sides, the 2½-ton air-lift *B* traveling on the overhead trolley takes its load to rack *C* in back of the heating furnace and on the same side as the drill sharpener so that the drills can be readily placed in the furnace. There the chains are unhooked from the box and the sides allowed to fall flat on the drill rack *C*. When all of the drills have been taken from the box during the progress of sharpening, the box is lifted with the air lift and taken over to rack *D* where it is put down between some pegs that will hold its sides up.

As fast as the drills are sharpened, they are sent over to the other side of the heating furnace to be tempered. On the tempering side is a cooling rack where the drills are held for the proper color to come and then are plunged into the cooling tank which is at the side of rack *D*. From the cooling tanks the drills are put in the boxes resting on rack *D*, being placed in the boxes of the mine to which the drills belong. As soon as all the drills for one shaft have been tempered, the boxes are picked up by the traveling air lift, taken back and loaded into the wagon that is standing under the loading place. Then the drills are hauled back to the shaft, where the boys sort out the drills belonging to each machine by the numbers that are cut in their shanks and load them on the cage, those for one machine pointing up, those for the next machine on that level down, thus each machine gets back as many drills as were sent up.

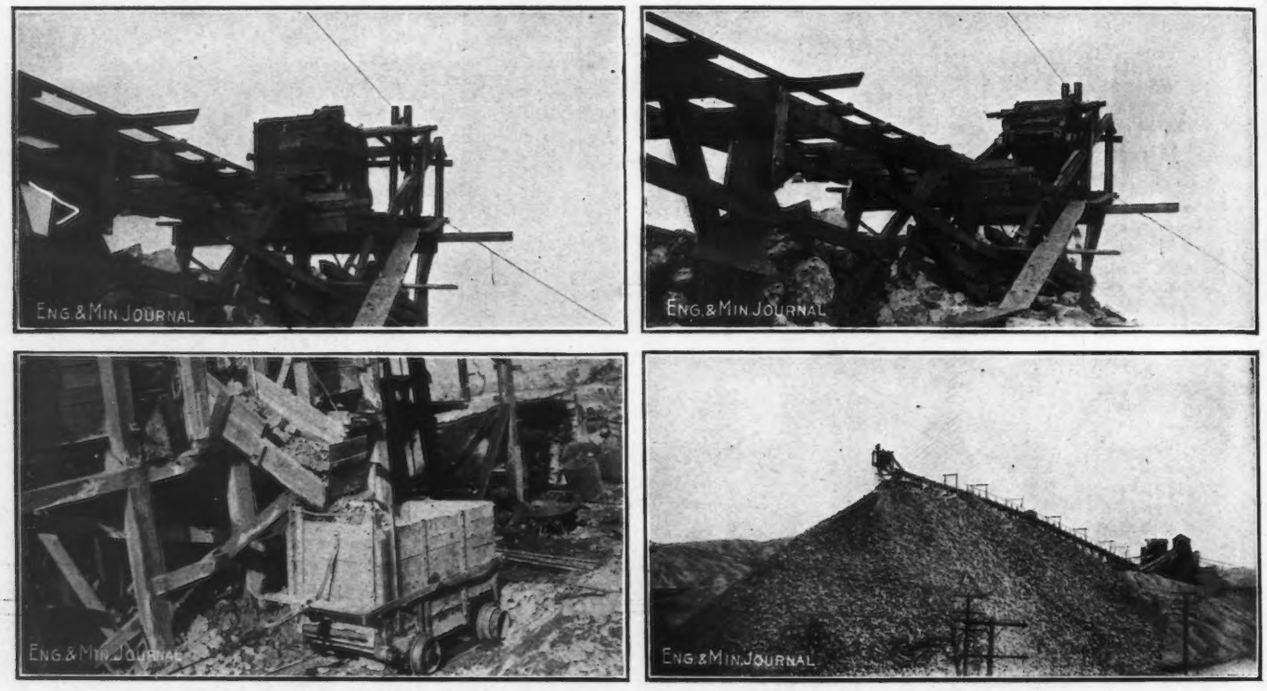
In this way the handling of the drills is reduced to a minimum, and yet all the advantages of central sharpening are retained for scattered shafts. The only investment other than would be required ordinarily is the providing of a wagon costing $50 or $60 to serve each shaft. The hauling is done by one of the teams that is maintained to do general hauling about the mine. This system of handling the steel has been in use for a long time at the Champion mine and is satisfactory.

Stacking Boulders

The boulders of waste that are sorted out of the Joplin ore at the grizzlies are usually loaded into a small car and trammed out on a trestle to the boulder pile near the shaft. At some mines it is not convenient to pile the boulders near the shaft and a long, high trestle is expensive to build. Moreover, on a flat site the boulder pile is rapidly extended if made only 40 or 50 ft. high. In some of the sheet-ground mines there is a layer of barren flint about 7 ft. thick that occurs between the upper and lower runs of ore. At mines where this flint is broken with the ore and is sorted out at the surface the boulder pile soon covers a large area.

At the Providence mine north of Webb City it is the practice to stack the boulders in the manner illustrated by the accompanying halftones. The same type of car is used for hauling the boulders as is used in transferring the ore from a bin at an auxiliary shaft to the mill hopper. In the illustrations the car shown at the loading chute is not the car actually used at the Providence mine, but is of the same type. The car is of the front-dumping type. The dumping device at the end of the trestle is made as shown in the illustrations. It is composed of two triangular frames tied together by cross-braces, the base of the frames serving as skids for sliding the frame along the top of the bents as the trestle is extended. The frame when in use is securely tied to several trestle bents. The sheave for the hoisting rope is carried on the frame so that the pull on the rope tends to hold the end timbers of the trestle from moving forward under the hammering it receives at the time of dumping. One of the top cross-braces which is securely bolted to the sill timbers of the frame serves to prevent overwinding, while blocks between the ends of this cross piece and the top legs of the dump also block the rear wheels, which follow the superstructure of the frame at the proper point to cause the dumping.

As the general view of the boulder pile shows, the trestle is extended upward at the outer end at a steep angle. When the pile is first started the trestle has to be extended frequently and the cost is therefore high, but as the pile is extended outward and upward the boulders can be piled to a greater height so that eventually extension of the trestle is necessary only at infrequent intervals.



BOULDER CARS, STACK AND TRESTLE AT PROVIDENCE MINE, JOPLIN MO.

At the Providence mine, ore is transferred from an auxiliary shaft to the mill hopper; therefore by using a hoist with two drums the same engine used in transferring of the ore can also be used to stack the boulders.

Placing Holes in Breast Stoping

BY HARVEY S. BROWN*

In stopes 30 ft. or more in width, breast stoping usually leaves a stronger and safer back than back stoping by "upper" holes. In breast stoping, the manner of pointing the holes has a definite influence on the condition of the back. Holes drilled approximately at right angles to the breast; i.e., parallel with the general direction of the advance, shake the back the least and are, therefore, the most desirable. Holes drilled parallel to the breast cause loosening of the back, necessitating more barring down, with attendant delays. The work can easily be arranged so as to permit pointing all the holes at right angles to the breast.

*Mining engineer, Victor, Colo.

Prospecting by Hydraulicking

A departure from the usual method of prospecting by trenching is to be made this summer on the property of the Nipissing Mining Co., at Cobalt, Ont. The hillsides will be cleared of drift by hydraulicking. The water will be pumped from a lake by a turbine pump direct connected to a motor that is guaranteed to raise 4800 gal. per min. against a head of 415 ft.; the pump will require 675 hp. It is expected that the hydraulic method will make it possible to discover the small veins that are often overlooked in trenching because of the difficulty of completely removing the drift and exposing a clean surface of rock.

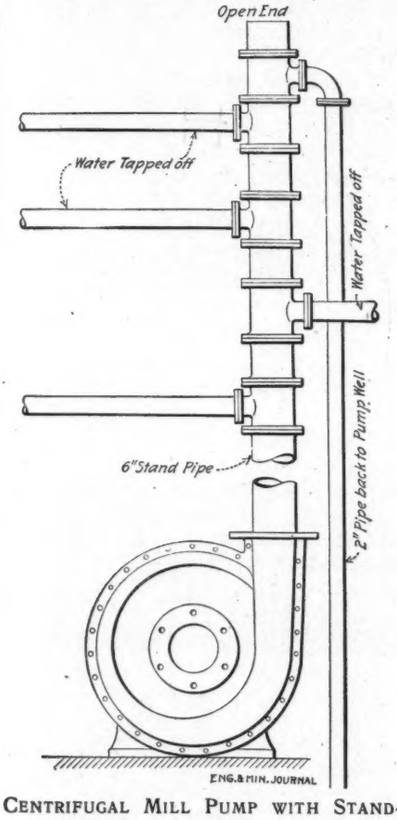
It is not the intention, according to a recent report by Arthur A. Cole, engineer of the Temiskaming & Northern Ontario R.R. commission, to run all the tailings from the hydraulicking into the lake. A small area of ground will first be cleared and a careful examination made of the exposed rock surface, then the drift from a small area immediately above the first will be washed down, covering the surface that has been examined and exposing fresh ground for examination. In this manner the entire area to be prospected will be gone over.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Standpipe on a Mill Pump

In some of the mills at Joplin, Mo. the pressure on the hydraulic classifiers and on the water going to the jigs and tables is regulated by small supply tanks into which the mill pumps raise the water and from which it goes to the different devices throughout the mill. This system has its drawbacks because when suspending operations, the water has to be shut off by cocks which are usually in some unhandy place or else allowed

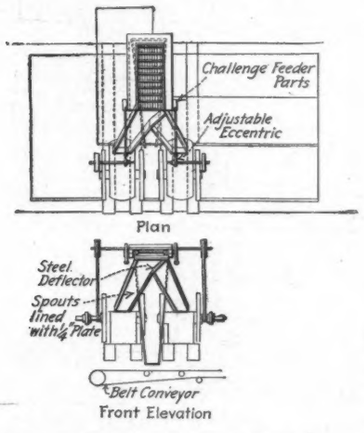


CENTRIFUGAL MILL PUMP WITH STANDPIPE

to run until the supply tanks are empty with the result that the wells of the elevators become flooded. Morever in case the valves are closed time is lost in making adjustments to re-establish the desired flow. In winter during freezing weather trouble is experienced where tanks are used because the mill is operated but two 10-hr. shifts per day and while the mill is not in operation the water in the pipes may freeze solid.

To avoid the inconveniences experienced with the supply-tank system, J. G. Marcum, a mill designer of Joplin, Mo., uses a standpipe immediately above the pump and takes water from it at the heights corresponding to the pressures that he desires. The standpipe is about 6 in. diameter, but the size depends upon the quantity of the water required in the mill. The top end of the standpipe is open and is provided with a small pipe to convey any excess water overflowing at the top back to the pump-well or the suction end of the pump. The speed of the pump is regulated so that there is only a slight overflow yet enough to insure a constant pressure in the mains.

When it is desired to suspend milling it is only necessary to admit air to the pump and the pipes and valves are all drained of water so that they cannot



CRUSHERS WITH GRIZZLY FEEDER

freeze. In the morning it is only necessary to start the pump after shutting off the air.

Field Test for Phosphate

With ammonium molybdate and dilute nitric acid, satisfactory field tests of phosphate rock can be made. The ammonium-molybdate crystals mixed with the powdered phosphate rock take on a distinctive yellow on application of the acid. This is a qualitative test only, as rock too low to be commercially available will respond to it.

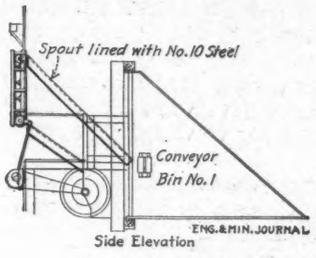
The Broken Hill South Silver Mining Co's. mill, New South Wales, producing a lead, zinc, and silver concentrate, consumes about 150 gal. of water per ton of ore. This includes all water used at the mine and the mill.

A Grizzly Crusher Feeder

BY S. A. WORCESTER*

The grizzly crusher-feeder illustrated by the accompanying drawings is used in a 60-stamp mill in which there are three ore bins, each supplying 20 stamps. In a former arrangement of the crusher floor there had been three crushers, one over each ore bin, and these were operated one at a time. The ore was delivered at the mill by a Bleichert tramway on which one man was employed in shifting buckets at the terminal and another in tramming the ore from the terminal to the crushers.

By removing the crusher over the ore bin farthest from the terminal and placing it at the side of the crusher over the



nearest bin it is now possible to dispense with the trammer and use this crusher as a reserve. This enables the terminal operator to attend to the feeder and concentrates all the crushing at one point.

As shown in Fig. 1, the ore from the crusher and the undersize from the grizzly drop directly down to the conveyor, which delivers by trippers or by end discharge to either of the farther bins. For delivering to the bin below the crushers, swinging deflectors, which are not shown in the illustration, are used. The grizzly feeder eliminating the shovelman, operates as follows: The terminal operator dumps the tramway bucket of a capacity of 800 lb. of ore on the horizontal grizzly, from which the rejections are slowly and positively raked over the end and into the spout leading into the crusher. The raking arrangement is similar to that of the chain-grate stoker used in boiler furnaces, and consists of two chains running over sprocket wheels and carrying a number of cross-bars provided with lifting fingers which travel below the upper surface of the grizzly and lift any ore which tends to hang between the bars.

*Mechanical engineer, Victor, Colo.

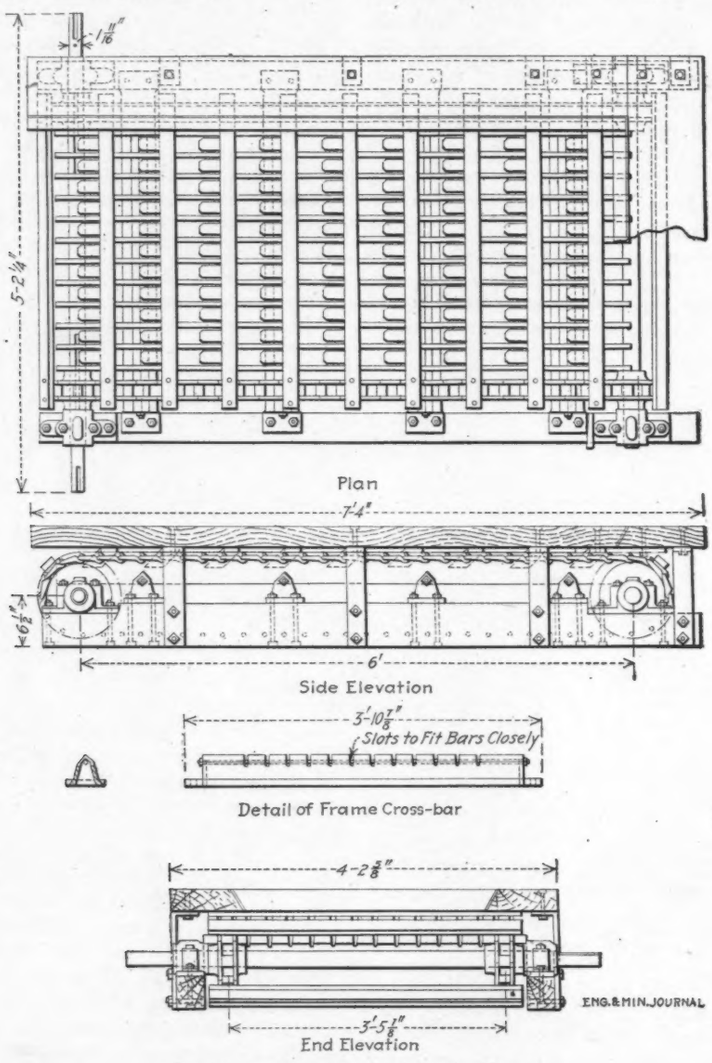
A deflector can be swung to direct the ore to the crusher which is in operation. The driving shaft of the feeder is given its slow, intermittent movement by a Challenge feeder friction device driven from an eccentric on a small countershaft driven from the crusher. The fines from the grizzly drop down the slope beneath to the conveyor or to the bin below. The rate of feed is regulated by adjusting the throw of the eccentrics. The sprocket chains are protected from dirt by a covering of planks. By the exercise of a little care in distributing the ore on the grizzly, the operator can easily avoid choking the crusher. The tapering section of the grizzly bars prevents any material from wedging below the top surface of the bars and the lifting fingers raise all material that tends to hang. The grizzly bars are firmly supported by substantial frame cross-bars to which they are secured by rods passing through the grizzly bars. The eccentrics, shafts, pulleys and pillow blocks were all taken from abandoned jigs, and the Challenge feeder parts were likewise on hand.

Portable Crusher and Elevator

At many of the shallow mines in the Joplin district, the quantity of ore mined in the early life of a property is not sufficient to justify the erection of a mill, and many operators do not care to pay the charge of $1 per ton for hauling and milling the ore at a custom mill in the vicinity of the mine. This is particularly the case with ore that is called free milling, or ore from which little middlings is produced. Such ore is well adapted to treatment an hand jigs after undergoing coarse crushing. In such instances a portable crusher, driven by a traction steam engine or a gasoline engine, is used to crush the ore.

The apparatus consists of a four-wheel wagon, strongly built of structural steel and capable of withstanding the jar of the crusher. The crusher is mounted in the center of the wagon, and a wooden platform is provided at the jaw opening, upon which is piled the ore to be crushed as it comes from the mine.

At the rear end of the wagon, there is a bucket elevator for raising the crushed material, which is directed into the buckets by a hopper suspended below the crusher. This elevator is driven by a sprocket and chain, driven by a belt from the crusher. The angle of inclination of the elevator can be varied by a worm-wheel on the wagon, which engages a toothed quadrant rigidly fixed to the steel frame that supports the elevator bucket line and the upper and lower pulleys. This frame is pivotally mounted, so that the entire elevator structure can be revolved until it lies parallel to the body of the wagon and above the crusher, facilitating the moving of the crusher from one mine to another.

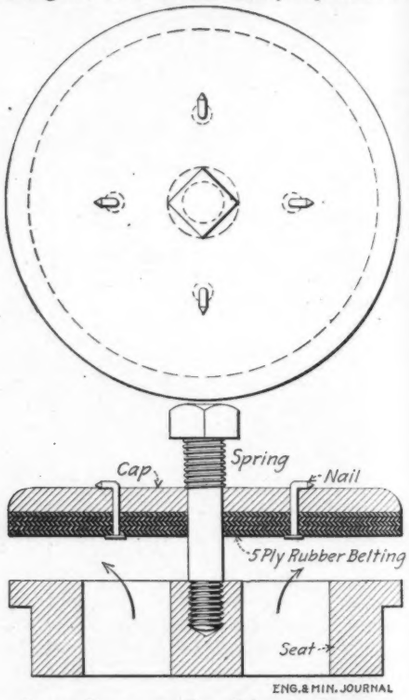


ENLARGEMENT OF THE GRIZZLY FEEDER

A Valve Protector

BY CHESTER STEINEM*

Lift valves, such as are used on the Deming and Gould pumps for pumping mill solutions, are usually subjected to severe wear, especially when operating on decanted solutions. A method of confining the wear to one easily replaceable part is shown in the accompanying sketch. At little expense ball valves may be altered so as to permit applying the same principle.



PUMP DISKS OF OLD RUBBER BELTING

A number of caps are kept on hand and these are pierced by four holes. Waste pieces of rubber belting are nailed and clinched to the caps and trimmed as shown. Punches, made of pipe ground to a cutting edge, would save time in punching. When a valve becomes worn, it is a simple matter to replace it.

*Mining engineer, Mogollon, N. M.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Pure Nigerian Tin

In the *Transactions* of the Faraday Society, Nov. 1911, p. 134, G. T. Holloway relates his experience with the little known Nigerian tin. He says in part:

"About 10 years ago, I received from Nigera some tin made by the natives from extremely pure alluvial tin ore, and smelted by them with wood charcoal under conditions where, although smelting was extremely crude, and the losses were heavy, the introduction of impurities was practically impossible. The tin was run by natives into straws or reeds, and the bars I had made from it formed the purest tin which I have ever examined. The highest grade tin which I had previously obtained and had used as a standard for analytical purposes, was found upon assay to be about 0.2 per cent. less pure than the Nigerian tin, in which I have been unable to find any impurity except a trace of iron.

Making Sodium Cyanide

Charles E. Acker's latest process for cyanide manufacture (U. S. pat. No. 1,019,002), embodies some rather novel features. A current of electricity is passed through an electrolyte of sodium and barium chlorides, using molten lead for the cathode. An alloy of sodium, barium and lead is formed, which is circulated through the apparatus by a centrifugal pump. In a so called reaction chamber, a large amount of finely divided charcoal is introduced, and a piston-shaped plunger is then lowered until slightly submerged.

Fuel oil is then introduced under pressure through this plunger, and is decomposed into hydrogen, which escapes, and carbon which, with some of the carbon of the charcoal, forms barium carbide. Nitrogen is then introduced through another pipe, which combines with the barium carbide to form barium cyanide. This is then decomposed by the sodium, regenerating the barium, and forming sodium cyanide.

$$Ba + 2C = BaC_2$$
$$BaC_2 + N_2 = Ba(CN)_2$$
$$Ba(CN)_2 + 2Na = Ba + 2NaCN$$

The sodium cyanide rises to the top of the bath, where it is drawn off from time to time. Owing to regeneration of the barium, it is only necessary to add sodium chloride to the electrolyte, except as some barium compound may be drawn off in the cyanide.

Roasting Ores for Wet Processes

For the effective preparation of roasted ores for leaching processes, a new process is given by Charles Gabrielli of Paris (U. S. pat. No. 1,018,609). In case pyrites, for instance, is being roasted, and the residue is to be leached for copper, a dead roast leaves part of the copper in insoluble form, and part of the iron in soluble shape, which then contaminates the leach.

Now, if to dead-roasted pyrites be added a quantity of green pyrites at a temperature between the decomposition temperatures of iron and of copper sulphate, a reaction will go on, between the raw and roasted pyrites, which will leave 90 to 100% of the copper soluble.

Or, in general, if the raw pyrite be added and the mixture kept at a temperature intermediate to the decomposition temperatures of the sulphates of two metals, that metal having the higher decomposition temperature for its sulphate will remain in soluble form. If the raw pyrite be added and the mixture kept at a temperature intermediate to the formation temperature of two metals, that sulphate having the lower formation temperature will remain in soluble state.

Separation of Iron from Manganese

If pyridine is added in slight excess to a neutral or slightly acid solution containing a mixture of iron and manganese, it is noticed that the iron is precipitated in the form of a hydrate, while the manganese remains in solution. It is thus possible (*Annal. de Chim. Anal.*) to separate rapidly 0.005 gram of manganese contained in 1 gram of iron.

One gram of pulverized ore is dissolved in warm concentrated hydrochloric acid, and is evaporated nearly to dryness to render the silica insoluble; this last operation is repeated two or three times, then water is added and the solution filtered. To the filtrate is added soda or potash until only slightly acid; the volume is made up to 200 cc., and sufficient pyridine is added to precipitate the whole of the iron. After boiling for 10 min, the mixture is filtered, and washed first with a strong solution of pyridine, and then with boiling water. In this way the iron remains on the filter while the manganese is in solution. When there is a large amount of manganese, the precipitated iron should be redissolved and then precipitated again in the usual manner.

Pyridine has no influence on lead or silver. At the same time it is advisable to separate these metals when found, then boil the solution in order to oxidize before adding the reagent. In the case where zinc occurs in the precipitate, it is necessary to reprecipitate with chloride of ammonia to separate zinc from iron.

Concentration and Leaching of Copper Ores

It is the idea of the recent patent of Rudolf Gahl (U. S. pat. No. 1,021,768) to crush copper-bearing ores to such a point that the separation of the mineral and the gangue is assured, without at all attempting to prevent sliming. The crushed ore is then concentrated and the tailings leached with ferric sulphate. It is stated that ores which in their natural state require leaching with hot concentrated solutions are, after removal of the concentrate, amenable to cold dilute leaching solutions.

The patent carries suggestions for manufacturing the original ferric-sulphate solution from mine waters, etc., and also describes various modifications, the addition of salt, chlorine or other reagents to the leach, or the production of a sand and a slime in the dressing so that one or the other may be discarded without leaching. The copper is precipitated from solution by scrap iron, and the ferrous-sulphate solution regenerated in any of the usual ways.

Determination of Lead, Nickel and Zinc as Oxalates

H. L. Ward has shown (*Amer. Journ. Sci.*, April, 1912) that lead may be precipitated by the addition of ammonium oxalate to a lead-nitrate solution, which contains enough acetic acid to break up the double oxalate of lead and ammonium formed. Glacial acetic acid should make up one-half the volume of the solution. The lead can also be precipitated readily by adding crystallized oxalic acid to a boiling solution of lead nitrate. Here again, the solution should contain about 50% of glacial acetic acid. The lead can then be determined by titration with permanganate.

Classen recommends precipitation of nickel as oxalate (*Zeitsch. Anal. Chem.*, XVI, 470), by breaking up the soluble nickel-potassium oxalate with a large

amount of acetic acid. In order to obtain a filterable product, the acetic acid must be run slowly into the boiling solution of double salt. The nickel oxalate thus obtained occludes much potassium oxalate and cannot be titrated. On ignition to oxide, large errors are also found, but the oxide can be washed free of potassium carbonate and the results are then reliable. By adding oxalic acid to nickel solutions, and then adding acetic acid after cooling, the nickel oxalate will come down fairly pure, although with small amounts of nickel it is necessary to heat to start precipitation. However, in attempting to titrate with permanganate, the green of the nickel masks the complementary permanganate pink. If cobalt be added to a slight pinkish tinge, the results are much better, but in general the procedure is unsatisfactory.

Zinc oxalate can be obtained using the precautions noted with nickel, but Classen's method gives a precipitate contaminated with potassium oxalate. The pure zinc-oxalate precipitate, not giving colored salts, may be titrated with permanganate.

Tasmanian Hydro-Electric Development

The right to utilize the Ouse and Shannon Rivers for hydro-electric power, and to conserve the waters of the Great Lakes for the same purpose, was granted the Hydro-Electric Power & Metallurgical Co., in 1909. Meteorological records show a rainfall sufficient, it is estimated, for generating 85,000 hp. under the 1000-ft. head available. The present installation, the headworks of which are now nearing completion (*Min. Journ.*, Apr. 13, 1912), will provide for 9000 hp. in the power house; weirs for 40,000 hp.; channels for 20,000 hp., and transmission lines for 20,000 hp. It is expected that cheap power will greatly stimulate mining in Tasmania.

Nickel in Norway

The production of nickel in Norway seems to be progressing, says *Echo des Mines*, Apr. 18, 1912. In 1911 the Evje company produced about 25,200 metric tons of ore. The smeltery treated 24,000 tons from the mine at Flaa, 2480 from the mines at Faœ (a separate company), 2070 tons of ore imported from Greece, and about 120 tons of matte from France. The metal content of the matte produced was: 418.5 tons of nickel, and 185 tons of copper. The company employs about 250 workers.

The old mines at Ringerike are being reopened and the ore will be smelted at the mines to matte, which will later be sent to the Christiansand nickel refinery. The Christiansand nickel refinery employs about 100 laborers, and workers on the Hybinette system. In 1911 it produced 285 tons of electrolytic nickel, and 80 of copper. This works is now being extended to produce 600 tons of nickel and 300 tons of copper per year.

Asbestos in the Urals

The production of asbestos in the Urals in 1911 showed an increase of 9,761,945 lb. over 1910, says *Viestnik Finanssoff*. The total production was 34,236,518 lb., which includes the production from the following mines: Baron Girard de Sukanton, 11,584,236 lb.; Poklieffsky-Kosiel, 11,104,974; P. O. Korieff's Successors, 7,124,407; Russo-Italian Co., 2,396,318; and N. V. Muchanoff & Co., 1,966,584 lb. The Poklieffsky-Kosiel company showed the greatest increase, the Korieff company a slight decrease. Productions of recent years have been: 1907, 19,607,462 lb.; 1908, 23,935,673; 1909, 29,390,237; 1910, 24,474,573; 1911, 34,236,518 pounds.

Osmiridium in the Urals

A report on the production of osmiridium in the Urals (*Min. Journ.*, Mar. 9, 1912) says that this mixture of the metals is found nowhere else in Russia, and even there is rare. It is usually found with gold in the Miassk deposits, Orenburg government, and in the Kyshtim deposits, western Ekaterinburg, but last year the only district which yielded osmiridium was the Miassk estate. The decline of the osmiridium industry may be followed from the accompanying table.

OSMIRIDIUM PRODUCTION IN THE URALS

Year	Troy Oz.
1902	144.7
1903	144.7
1904	156.5
1905	107.1
1906	44.8
1907	69.0
1908	54.4
1909	56.6
1910	52.2
1911	4.7
Total, 10 years	834.7

Pyrite Mines of the World

The chief commercial pyrite deposits of the world are given as follows by the *American Fertilizer*, Mar. 23, 1912:

The mines of Virginia, Georgia and a few other states, producing about 200,000 tons annually, of which the Arminius mine, of Virginia, produces about half; the provinces of eastern Canada, and Ontario and Quebec; the mines of Röres and Sulitelma in Norway, the former producing 20,000 tons for export, the latter 35,000 tons for export, per annum; Brosso, Italy, 25,000 tons per annum; the immense deposits of Sain-Bel, France, east of the Brevenne, producing annually about 325,000 tons of high-grade ore; in Germany, several important deposits, of which the output is all taken by German works, two mines at Meggen produce about 150,000 tons annually; most important of all, the mines of Spain and Portugal.

Of the deposits of the Spanish peninsula, those known as the Huelva are the most important, lying in the Spanish province of Huelva, and the Portuguese province of Alemtejo, between Rio Tinto and San Domingo. These deposits cover a zone from 12 to 20 miles wide by 120 miles long. The San Domingo, La Zarza, and Tharsis mines lie near the middle of this zone. These mines have been worked since the time of the Phœnicians, and the available deposits are now estimated at about 1,000,000,000 tons.

Spanish ore sells at about 13c. per unit of sulphur. Freights are estimated at about $2.74 per ton from Spain to the United States, and wharfage at about 45c. per ton.

Refining Metals with Titanium

The uses of titanium to purify metals or alloys, such as zinc, lead, aluminum or jeweller's alloys, is the subject of recent patents granted to A. J. Rossi (covered respectively by U. S. pat. Nos. 1,020,514; 1,020,512; 1,019,531; 1,022,600). The method of using titanium as a purifier is preferably to add a rich alloy of the metal to be purified, and titanium, say 10 to 12% Ti, in an amount equivalent only a trifle over the theoretical amount of titanium necessary to combine with the impurities present. Carbon, nitrogen and oxygen are the elements most easily taken up by the titanium. Jeweller's alloys are preferably made with copper previously purified by titanium. The purification of aluminum by this means seems to mark a decided step in the metallurgy of that element.

Magnesia for Floorings

It is stated that in Germany flooring for public and office buildings is being made from a mixture of magnesia and sawdust, wet with magnesium-chloride solution (*Daily Cons. and Trade Reports*, Aug. 7, 1911; Apr. 17, 1912). The mixtures are not patented, but the manufacturers keep them secret.

Whereas the magnesia flooring was first used as a base for linoleum, it has been found possible to give the mixture a good color, and a fine marble-like finish, in which case it costs about $1.34 per sq.m. It is stated to be crack-free, warm under foot, elastic, and sound- and waterproof.

Struverite in Perak

Some strüverite was recently found in the Kuala Kangsar district, Perak, Federated Malay States, which, on analysis, gave: TiO_2, 45.74; Ta_2O_5, 35.96; Nb_2O_5, 6.90; FeO, 8.27; SnO_2, 2.67 (*Chem. Trade Journ.*, Mar. 23, 1912). The only constituent likely to be of present value is tantalum.

How the Metals Are Sold—Copper—I

By W. R. Ingalls

An account of the customs and practices obtaining in the marketing of an important metal and the conditions that determine them.

The interest of the miner and the metallurgist extends to the production and disposal of the refined metals. In their subsequent utilization by the drawers of wire, rollers of sheet, etc., he usually has no concern. The last step of interest to him, and this is of vital interest, is consequently the sale of the refined metals. The details of the selling, the methods and conditions thereof, and in short all that pertains to the marketing are not, however, well understood. There have been, in the JOURNAL, many articles upon this subject, but even in such a matter as selling metals there are changes in practice and therefore this present series of articles will not be wholly a repetition of what has been said previously. It is not my intention to touch upon the selling of iron and steel, or of many of the minor metals, such as antimony, nickel, etc., but rather to confine myself to copper, lead, zinc and tin, with brief references to aluminum and quicksilver. I shall begin with copper as the metal of superior interest.

I shall not enter far into the subject of statistics. It will be sufficient to remark that at present the world's production of new copper is about 2000 million pounds per annum, whereof about 1450 million is the product of American refineries. The predominance of America in the world's market is therefore self-evident. This predominance is emphasized if it be further stated that of the remaining output a considerable portion is consumed in the respective countries of production, e.g., this is the case of Russia, and is not competitive.

Besides the new copper there is a considerable production from scrap and junk, which to all intents and purposes is equivalent to new copper. In the United States this production amounts to about 60 million pounds per annum.[1] It appears therefore that the total production of copper in the United States is fully 1500 million pounds per annum, the disposal of which implies the selling of an average of five million pounds per day of business. It is evident from these figures that transactions in the copper market must go on all the time and that in the dealings of first hands they must be of high order of magnitude. In the business from this standpoint the carload is representative merely of retail trading; one hundred thousand pounds is a relatively trifling unit; a million-pound lot is only ordinary in periods of activity; and transfers of much larger blocks are common. Transactions to the amount of 30,000,000 lb. per week only dispose of the current production, without allowance for resales. When the market is classed as dull, a weekly business to the amount of many millions of pounds is likely to be done, but less than the average. Business has to be upward of 30,000,000 lb. per week to be pronounced brisk.

KINDS OF COPPER

Copper is marketed in four principal kinds, viz.: 1, Lake; 2, electrolytic; 3, pig; 4, casting. Lake and electrolytic are marketed in three principal forms, viz., cakes, wirebars and ingots. Pig copper, as its name implies, is sold in pigs, while casting generally goes in the form of ingot. Cakes are commonly rectangular slabs of the metal; rarely discs. Cakes are used chiefly by the rollers and spinners. Wirebars are long bars, of square cross-section, tapering at one end to facilitate passage through the rolls of the wire mills. Ingots are the well known pigs that are partially divided into two or three sections, which is to facilitate the breaking of them for introduction into melting pots. Ingot copper is in fact used chiefly by the makers of castings and alloys, brass being the most important of the latter. Besides the ordinary ingots there are also what are called "ingot bars," weighing 60 to 90 lb., which are divided by three to five notches.

Cakes and wirebars as furnished by the several refiners are generally of about the same size and shape, but there are some manufacturers who require special shapes and often pay a premium for them. Sales of copper at a fancy price are occasionally reported in the newspapers and heralded as marking an advance in the market, whereas in fact they represent merely some purchase of copper in a special shape and perhaps also of a special brand.

LAKE COPPER

As its name indicates, Lake copper is produced by the mines of Lake Superior, and indeed it is produced only by them. Formerly it was relatively of much more importance than it is now, but during the last 20 years electrolytic has displaced it as the kind of metal of superior importance although in certain ways it still retains the premier position. Electrolytic is, however, now conceded to be superior to Lake in conductivity and equally good in some other respects. Lake copper is superior in the combination of high conductivity with high toughness, but in the main it holds the esteem that wins for it a premium in the market to a hoary prejudice on the part of some manufacturers who continue to demand it because they always have, because it has proved good, and because they don't want to take chances in trying anything else. Given two lots of the same metal cast in different molds, one with an old, well-known name and the other with a new one and some melters will report different results. Such absurdity is gradually disappearing with the introduction of the chemist into the brass works and other factories.

Lake copper is marketed as three distinct kinds, viz., special brands (Calumet & Hecla and Quincy); prime Lake (Tamarack, Osceola, Wolverine, etc., including the electrolytic Lake refined by the Calumet & Hecla at Buffalo); and arsenical (Copper Range, Isle Royale, etc.) These brands command different prices, the specials generally realizing a little higher and the arsenical a little lower price than the good, ordinary Lake copper. However, this is not always the case. At some times the arsenical copper sells on a par with first-class casting, but there have been times when a demand for copper high in arsenic has brought for it a price superior to prime Lake copper.[2] Similarly there have been times, especially during periods of decline in the market, when the best grades of Lake copper have been sold on the same terms as electrolytic. In general, however, prime Lake copper commands about 0.25c. per lb. more than electrolytic, basis New York, but not so much on basis of delivery. Further on I shall dwell more in detail upon this subject. Lately the

[1] Statistics of the recovery of copper from scrap and junk are conflicting and confusing unless they be carefully defined. Most manufacturers of copper have scrap and trimmings, which they remelt or return to the refiners for remelting. Manifestly such copper should be excluded from statistics because it has never been used. The correct view of the secondary recovery of copper is, in my opinion, confined to what is obtained from the reworking of old material; i.e., material that has been used, collected, and restored to the market in the form of ingot, etc., thus becoming to all intents and purposes new copper, with which it is in fact competitive. Such recovery is practiced not only by smelters who make it their special business, but also by the refiners whose chief business is the treatment of virgin copper.

[2] The arsenical Lake copper constitutes a class by itself, having a distinct market. It cannot be used in place of prime lake, nor of electrolytic, but finds employment either as casting copper or rolling copper. For the latter purpose it is in good demand, owing to the high tensile strength of the sheet made from it.

Calumet & Hecla has been making a differential of ⅛c. per lb. between its Torch Lake and Buffalo copper.

Electrolytic Copper

The production of electrolytic copper now amounts to about 80% of the total American production, and 70 to 75% of the world's production. Because of its excellence and the magnitude of its supply it occupies the leading place in the copper business. When the price for copper is referred to without qualification the common understanding nowadays is that the price for electrolytic copper is meant.

The electrolytic copper produced by the several refineries is substantially uniform in quality. Certain brands, e.g., B.E.R. and N.L.S., have at times enjoyed a little preference and indeed have commanded a small premium, but at present no material differences are recognized and the respective agencies compete upon an equal basis. The standard specifications, approved Feb. 18, 1910, provide that all wirebar and cake copper shall have a purity of at least 99.9%, silver being counted as copper, and an electrical resistivity not greater than 0.15535 international ohm per meter-gram at 20° C. The specifications of the American Society for Testing Materials adopted in 1911 are as follows:

(3) The copper in all shapes shall have a purity of at least 99.880% as determined by electrolytic assay, silver being counted as copper. All wirebars shall have a conductivity of at least 98.5% (annealed); all ingots and ingot bars shall have a conductivity of at least 97.5% (annealed), excepting only arsenical copper, which shall have a conductivity of not less than 90% (annealed). Cakes, slabs and billets shall come under the ingot classification, except when specified for electrical use at time of purchase, in which case wirebar classification shall apply. The annealed copper standard, or resistance of a meter-gram of standard annealed copper at 20° C., shall be considered as 0.15302 international ohm. The percentage conductivity for the purposes of this specification shall be calculated by dividing the resistivity of the annealed copper standard by the resistivity of the sample at 20° Centigrade.

(4) Wirebars, cakes, slabs and billets shall be substantially free from shrink holes, cold sets, pits, sloppy edges, concave tops and similar defects in set or casting. This clause shall not apply to ingots or ingot bars, in which case physical defects are of no consequence.

(5) Five per cent. variation in weight or ¼ in. variation in any dimension from the refiner's published list or purchaser's specified size shall be considered good delivery; provided, however, that wirebars may vary in length 1% from the listed or specified length, and cakes 3% from the listed or specified size in any dimension greater than 8 in. The weight of ingot and ingot-bar copper shall not exceed that specified by more than 10%, but otherwise its variation is not important.

These specifications do not take into consideration the so-called casting copper used for the purpose of alloying with other metals to produce cast shapes.

Brands of Copper

A list of the important brands of copper in the American market is as follows:

American Smelting & Refining Co.	P A
American Smelters Securities Co.	BER, BCW,† Tacoma
Anaconda Copper Mining Co.	M A
Arizona Copper Co.	A C C†
Balbach Smelting & Refining Co.	Bb† N B C
Calumet & Hecla Mining Co.	C & H M Co.
Copper Range	C R
Nichols Copper Co.	N L S, R M C
Phelps, Dodge & Co.	C*Q, P D C†
Quincy Mining Co.	Q M Co.
Raritan Copper Works	N E C
Tamarack & Osceola	T M Co.
Tennessee Copper Co.	T C C†
U. S. Metals Refining Co.	D R W

†Casting.

Smelting and Refining

The smelting of Lake copper is a relatively simple process as is also the refining, which is done in the same works. These works are near the mines in Michigan, except the plant of the Calumet & Hecla at Buffalo, N. Y., and from them the copper goes directly to the manufacturers. The C. & H. works, at Buffalo comprise an electrolytic refinery in which some of the more argentiferous copper is refined. The copper so refined continues to be classed as Lake copper. At the Dollar Bay smeltery a proportion of Montana cathodes used to be melted with the Lake copper, the product going into the market as "Lake."

The refiners who rework scrap and junk, producing casting copper, employ reverberatory furnaces, the refining process being simple.

All of the other producers of copper turn out a first product known as pig or blister copper, this being the crude metal poured from the bessemer converters. Nearly all of the producers have converter plants, but a few ship their product as matte to other converters. The refiners receive a small proportion of their crude copper in the form of anodes, some of which is not strictly blister copper.

The bulk of the blister copper goes to the electrolytic refiners, it being necessary both to eliminate impurities and to extract its gold and silver content. Some of it, however, is non-argentiferous and sufficiently pure as it comes from the converters to be used as casting copper after a simple furnace refining. Such copper is marketed as pig or bessemer copper and to a large extent is exported. The product of the Arizona Copper Co., Detroit Copper Co. and Tennessee Copper Co. is of this class. Some of it contains enough silver to be near the dividing line and goes directly into consumption or to electrolytic refining according to commercial conditions, sometimes one way, sometimes the other. At present only the ACC copper is sold as pig. The product of the Detroit Copper Co. is marketed as PDC (casting) and that of the Tennessee Copper Co. is either marketed as casting or is electrolytically refined.

The first marketable product of the electrolytic refiners is cathode copper, i.e., the refined metal in large, rough, electrolytically deposited plates coming from the tanks. The cathodes go generally to melting furnaces wherein the process of refining is completed and whence the copper is cast as cakes, wirebars, or ingots, but there are some buyers of cathodes who do the rest of the process in their own works. Much less cathode copper is sold now than formerly. The major part of what is disposed of in this form goes to Europe. The cathode allowance for export is variable, ranging from 5 to 10s. per 2240 lb. (0.054 to 0.108 per lb.). In shipping copper in this way heavy losses in weight (0.25 to 0.75%) occur, owing to the brittleness of the plates and the rough handling in loading and unloading.

Electrolytic Refineries

The following is a list of the electrolytic copper refineries of the United States, together with their situation and a statement of their capacity at the end of 1911:

Works	Location	Capacity, Pounds
Nichols	Laurel Hill, N. Y.	330,000,000
Raritan	Perth Amboy, N. J.	330,000,000
Baltimore	Canton, Md.	288,000,000
A. S. & R. Co.	Perth Amboy, N. J.	180,000,000
U. S.	Chrome, N. J.	180,000,000
Balbach	Newark, N. J.	48,000,000
Anaconda	Great Falls, Mont.	65,000,000
Tacoma	Tacoma, Wash.	28,000,000
C. & H. Min. Co.	Buffalo, N. Y.	55,000,000
Total		1,494,000,000

The Selling Agencies

A few of the producers sell directly their copper and handle no other copper. This is the practice of the Quincy, Miami, Mohawk and Wolverine companies; also of some of the smaller Lake companies. Other companies sell their own copper and also act as agents for other producers. Thus, the Calumet & Hecla sells the product of the other Lake companies in which it is a stockholder. The Anaconda Copper Mining Co., through the United Metals Selling Co., sells the Cananea, Copper Range and Highland Boy copper. Phelps, Dodge & Co. sells the Calumet & Arizona. The American Smelting and Refining Co. sells the Utah, Nevada, Ray, Chino and Tennessee copper. These concerns sell their outside copper on commission, the rate now being commonly 1%. The American Metal Co. and L. Vogelstein & Co. act both as agents and as traders. The one large producer, Calumet & Hecla, and the five agencies that have been mentioned sell about 80% of the total Ameri-

can copper product. Beer, Sondheimer & Co., E. P. Earle, and one or two other concerns handle relatively small quantities.

These concerns constitute the "first hands." Besides them there are numerous dealers who conduct a speculative or distributive business, or a combination of both. Their supplies, barring what comes from the scrap and junk smelters, are of course obtained from the producers and agencies, either by purchase or by representation. Virgin copper has been known to be delivered against sales through unusual channels. As to the purely speculative business, reference will be made in a subsequent section of this article.

International Relations

Approximately one-half of the production of American refineries is consumed in the United States; the other half is exported to Europe. Copper moves freely from one country to another, there being no import duties except into Russia and perhaps some minor countries. These conditions create an international market for copper, i.e., the American and European price is in general the same, allowing for freight differentials. The principal nominal markets are New York and London; the only other public market that comes into consideration is Hamburg. In importance Hamburg is decidedly inferior to London, to which in the main it conforms.

In New York the dealings are wholly in refined copper; in London they are both in refined sorts and in what is known as "standard" under a form of contract determined by the metal exchange which classifies and rates most of the commercial kinds of copper. Transactions upon the London Metal Exchange are conducted under systematized rules and the open market that is thus established is the focus of extensive speculation, which is no more confined to London itself than are the transactions on the New York stock exchange confined to Wall Street. Both of these places are simply the points of execution of orders emanating from all parts of the world. Thus, many of the speculative movements executed in the London copper market originate from orders cabled from New York and several American houses are prepared to conduct such business, in which public interest upon certain occasions has been openly invited, just as it might be invited to participate in speculation in cotton or wheat.

In view of these connections it is obvious that while the London and New York copper markets may temporarily exhibit a disparity, such a condition can not long exist, generally for not more than a few days, inasmuch as disparity immediately opens the way to profitable arbitrage business. If "standard" at London rises above the New York parity the American agencies may sell contracts and deliver their refined copper against them. On the other hand, if "standard" falls below the parity they may cause their refined copper to move at concessions and cover their sales by purchases of "standard" in London. There are frequently triangular and even quadrangular or more complicated transactions, such as occurred several years ago when China was playing an interesting part in the copper market. The details of these are often too abstruse to be understood by anyone except the traders who make it their business. The number of houses in a position to conduct arbitrage business is in fact small.

A consideration of the nature of this international business makes it manifest that the American and European markets must stand at the same level during most of the time. A movement may start in London or New York; if the start be in London it may be specifically inspired from New York; and a general change in level may be anticipated on one side or the other, which is why New York watches London so carefully, and vice-versa, but natural conditions prevent any disparity from being of anything but temporary character.

New York a Basing Point

While New York is the great market for copper and while the price for copper in New York is the commonly accepted basis, a great deal of the copper sold, perhaps the major part, never physically enters New York. The electrolytic refineries, with a few exceptions, are situated on branches of the bay of New York, four of them being in the State of New Jersey and only the Nichols works in New York. This, however, is merely a technical distinction, three of the large New Jersey refineries being separated from the municipality of New York only by a narrow body of water. At the refineries the copper is loaded on lighters by which the copper is taken to the steamship docks for export or to the railway docks for transhipment to interior domestic places. In a few cases direct delivery to manufacturers can be made by lighters and to some extent the copper is shipped directly from the refineries in railway cars. The greatest manufacture of copper is on the Atlantic Coast, and especially in the Naugatuck valley in Connecticut. There are important isolated centers, such as Trenton, N. J., Rome, N. Y. and Detroit, Mich. The copper that goes westward from New York has to stand a back freight through the longitude that it has already traversed in coming eastward as blister copper. Not so with the electrolytic copper coming from Tacoma and Great Falls or the Lake copper from Michigan. When copper is delivered from western refineries to western manufacturing points it is a common practice of the Lake producers to settle on the basis of the New York price with freight allowance. In the case of the electrolytic producers conditions are more complicated because of the trade custom respecting delivery.

Price Bases

The price for copper is quoted to buyers in a variety of ways, whereof the more important are as follows: New York, cash; delivered, 30 days time for payment; delivered, cash; delivered, cash, less 0.5% discount; f.o.b. dock, New York (for export); delivered in Europe, c. i. f. (cost, insurance and freight). Formerly copper was sold on a strictly cash basis. At present the custom of granting time prevails in the domestic business, the larger part of the copper being sold on terms that include delivery at the buyer's works (the seller paying the freight), allowing 30 days (after arrival of the copper) for payment; and discounting the bill for cash. This is the meaning of the common, commercial phrase "delivered, 30 days." The custom of quoting copper in this way is now so general that the explanatory phrase is commonly omitted, which makes it necessary to employ an explanatory phrase when the basis be different. If it be said in the trade that the price of electrolytic copper is 14c. it is understood what that means, but outside of the trade such an understanding does not generally exist. The net, cash price, basis New York, is of course a very different thing from the price delivered, 30 days. In the foreign business the c. i. f. basis is also one of delivery, the seller landing the copper at some European port.

The practice of selling copper to domestic manufacturers[1] on the delivery and time basis was, I believe, inaugurated in the '90s. Lake copper was naturally delivered to them directly from the West and in introducing the then new kind of copper—electrolytic—coming from the West via New York it was reasonable to offer it to the manufacturer on terms that relieved him of a study of freight rates. The innovation of time allowance against the old cash basis was inspired doubtless by competitive reasons and coincided with the elimination of the middleman (broker), the rise of the great agencies possessing large financial resources, and the direct dealing with manufacturers whose credit was good and well known. Losses through bad accounts in the copper business as now conducted are almost an unknown occurrence.

[1]Throughout this article I refer to the "manufacturer" rather than the "consumer." The real consumer rarely enters directly into relations with the refiner. The latter sells to the manufacturer of wire, etc., who is simply a middleman one step further in advance. There are, however, some large users of wire, such as the General Electric Co. and Western Electric Co., which buy wire bars and have them drawn on toll or contract, but even they are not the ultimate consumers.

The granting of time on copper bills is of course a concession to the buyer, because the latter gains and the seller loses interest on the money, although this is not figured by some producers in their accounts. They reckon a sale as a sale irrespective of when they receive their money, but the interest on the money involved in the transaction accrues to some one, nevertheless, and is recognized in the discounting of bills for cash.

The time allowance is not a commendable practice or to the best interest of the business. At certain times it has been abused. In shipping to Connecticut the refiner in New York figures upon financing the consignment for about 45 days, the time while the copper is in transit being about 15 days. The buyer may take advantage of the agreement by delaying the receipt, i.e., delaying weighing in or entry upon his books, from which he begins to count his 30 days, and the seller is impotent, being anxious to avoid giving offense, especially when competition is keen.

(To be concluded)

Geology of the Jarbidge District, Nevada*

The Jarbidge district is in the northern part of Elko County, Nevada, near the Idaho state line on the north and about 60 miles from the Utah state line on the east. The district comprises an area about 14 miles square; it lies in rugged mountains that range in elevation from 5500 to 11,000 ft. The nearest railroad stations are Rogerson, in Idaho, 50 miles to the north, on a spur of the Minidoka & Southwestern branch of the Oregon Short Line, and Deeth, in Nevada, 55 miles to the south on the Southern Pacific and Western Pacific railroads.

The district lies in an area of folded and tilted, principally Paleozoic sedimentary rocks, cut by granular intrusives and flooded by Tertiary lavas. The rock groups of the region, beginning with the oldest, are Paleozoic sedimentaries, post-Paleozoic intrusives, early Tertiary and late Tertiary lavas, Tertiary sedimentaries and Quaternary deposits. With reference to the mineral deposits the early Tertiary lavas are the most important.

Veins Formed in Fissures in Older Rhyolites

The intrusion and deformation of the Paleozoic sediments by stocks and dikes of granite and their erosion was followed by the eruption of Tertiary volcanic lavas that more or less completely flooded the region. Among these lavas rhyolite is the most abundant and widely distributed. At or soon after eruption, the older rhyolites were fissured mainly by crustal movement attended by faulting. The fissures thus produced are now occupied by the gold-bearing quartz veins of the district, and a few of them by rhyolite dikes.

The faults, including the vein fissures, seem to be mostly normal, and occur roughly in two groups; the west group, mainly in the west slope of the Crater Range and along the Jarbidge River, and the east or Crater group, mainly in the upper east slope of the Crater Range. The faults of the west group strike northwestward and dip steeply to the east; those of the east group strike more nearly north and dip steeply to the west against the dip of the west group. The rocks are cut by rhyolite dikes that were probably derived from the same magma as the intruded rocks.

The younger rhyolites were poured out from essentially the same vents as the old lavas. In places they are gently folded and slightly faulted, but compared to the older flows they have not been much deformed.

Two Periods of Mineralization

The district shows at least two distinct periods of mineralization. The deposits occur in two sharply contrasted groups that differ considerably in age; the early occurring in or associated with the sedimentary and early granular intrusive rocks, and the late, in the rhyolite. The early, Cretaceous (?) deposits are said to occur chiefly as tabular fissure veins, containing gold, silver, copper and lead in quartz gangue. They occur mostly near the contact of the Paleozoic quartzite and limestone, and the granular intrusives; both classes of these rocks are cut by the veins. These deposits have not yet been extensively developed.

The most important are the later deposits which occur as tabular, gold-bearing quartz fissure veins or lodes in the rhyolite. They are in general well defined and contain angular inclusions of rhyolite, sedimentary rocks and seams of clay. The veins, about 40 in number, range from 1 to 20 ft. in width, from less than 1000 ft. to several miles in length, outcrop prominently, rising in places to more than 60 ft. above the surrounding surface, and show a vertical range in some individual cases of nearly 2000 feet.

Two Systems of Veins

The veins consist in general of two main systems or groups which gradually diverge northward, but which are not everywhere sharply differentiated, and converge downward. They occupy chiefly normal fault fissures. The west system comprises the wider and more important deposits, and the most prominent outcrops. The most important of these deposits are concentrated in a belt about a mile wide and three miles long. They contain more brecciated material and the walls are more irregular than the east system.

The inconspicuous outcrops of the east system show a vertical range of more than 4000 ft. They appear to occur mostly at geological horizons nearly 2000 ft. higher than the western veins. They are narrower, one to four feet, and more persistent horizontally, some being said to have a length of three miles. There is also a subordinate cross system of veins, striking almost at right angles to the two main systems.

Characteristics of the Veins

The veins are composed of characteristically laminated pseudomorphic milk-white quartz-andularia gangue, usually stained reddish brown to black or yellow in the outcrops and surface workings. The minerals in the deposits are chiefly andularia, apatite, argentite, calcite, chalcedony, chlorite, epidote, fluorite, gold, gold-silver alloy, hematite, kaolin, limonite, manganese oxide, marcasite, muscovite, opaline silica, orthoclase, pyrite, quartz, sericite, silver and talc.

Both the croppings and the gangue in the veins show free gold, the principal metal, which may be obtained by panning. Good ore usually yields a long streak of bright gold in the pan. The silver occurs chiefly as argentite. The quantity of silver is usually small, amounting to only 2 oz. per ton of ore, but in some cases as much as 90 oz. has been reported. While plates, specks and blebs of gold are often seen, most of the gold is finely divided and invisible. In most of the veins it is concentrated in streaks or pay shoots. The grade of the ore ranges from low to very high, the shipping ore from some veins assaying $600 to $1000 per ton. A sample from the Bluster vein over a width of 5 ft. assayed $60 per ton. It is, however, too early to form any idea of the average value of the ore of the district.

While on the whole the gold appears to favor the quartz portion of the gangue where quartz is plentiful, in many places it seems to occur independently of both quartz and andularia. The gold of the western veins is high grade; that of the Bluster mine has a deep yellow color and assays $20 or more per oz. In the eastern veins the gold is light colored, contains much silver alloy, and assays about $12 per ounce.

*Abstract from Bull. 497, U. S. Geological Survey.

Weston Normal Cell

The technical committee, appointed by the International Committee on Electrical Units and Standards, has reported through S. W. Stratton, of the U. S. Bureau of Standards, that the electromotive force of the Weston normal cell should be considered 1.1083 volts at 20° C. This may be changed by a few parts in 100,000 when the committee finally reports on the final specifications for the silver voltameter.

Mines and Ores of Porcupine

By Reginald E. Hore*

The gold occurs free, or intergrown with pyrite, in quartz veins. The country rock is gray sericite-quartz-carbonate schist, conglomerate, slate or ferrodolomite, generally containing pyrite. At the Hollinger, galena and sphalerite are considered good indications of rich gold ore. Mill tests show that good extraction is possible by combined amalgamation and cyanidation.

*Mining Geologist, Houghton, Mich.

In the summer of 1909 prospectors working in the vicinity of Porcupine Lake, 360 miles north of Toronto, 100 miles northwest of Cobalt, and 25 miles west of the Ontario government railroad, found a number of promising gold-quartz deposits. During the following winter machinery was taken in to explore the properties and two of them, now known as the Dome and the Hollinger, were proved to be exceedingly valuable. On many other properties, notably the Miller-Middleton, Vipond, Rea and McIntyre, promising finds were made.

The Dome Mine

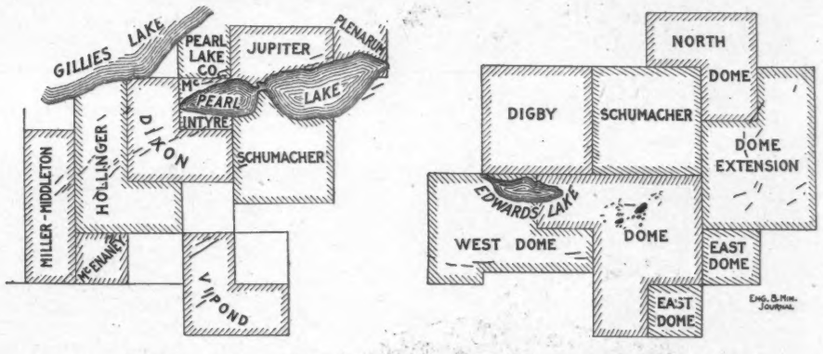
The Dome Mines, Ltd., owns 240 acres, six mining claims, in Tisdale township. On one of the claims two large masses of gold-bearing quartz are exposed, and near the large masses are numerous smaller masses and veins. The country rocks are gray schists, conglomerate and slate.

Near the quartz, almost all the rocks are impregnated with carbonates. The schist is composed largely of sericite, carbonates and quartz with smaller amounts of chlorite and magnetite. It commonly contains near the quartz numerous striated cubes of pyrite. The conglomerate has a matrix of fine quartz, sericite, quartz and carbonates with a few large grains of quartz and feldspar. The pebbles are chiefly light-colored altered quartz-porphyry.

The quartz in several places shows coarse gold, especially in parts near the wall rock or inclosed masses of rock. Most of the gold is in parts of the quartz that have been crushed. Apparently the quartz was originally made up largely of grains 0.5 to 1 mm. in diameter; but much of it is now in grains 0.02 to 0.05 mm. in diameter which have been formed by granulation of the larger grains. The quartz contains numerous fluid inclusions and shows strain shadows. Most of the visible gold is inclosed by quartz. Some is wholly or partly inclosed in calcite or other carbonates. Some is intricately intergrown with pyrite. In the quartz are numerous crystals of pyrite and the gold is commonly near the pyrite; but in several sections examined microscopically only a small proportion is actually intergrown with it. Minute streaks and patches of sericite and carbonate are common and much of the visible gold is among the granulated quartz near these minerals.

Mill tests have shown that most of the gold can be readily recovered by amalgamation if the ore is finely ground. By grinding to pass 90% through a 200-mesh screen, 84% of the gold was recovered by amalgamation. Sands from the stamps will therefore be recrushed in tube mills. The ore was found to be particularly free from cyanicides and the tailings can therefore be profitably treated by cyanide.

During 1911 surface prospecting at the Dome resulted in some important discoveries. One vein uncovered northeast of the larger quartz mass shows remarkable patches of coarse gold and has become known as the "Golden Stairway." A shaft is now being sunk to explore this vein. In excavating for the mill site other quartz veins showing much coarse gold were encountered. A large number of diamond-drill holes have been bored with satisfactory results.



TWO IMPORTANT VEIN SYSTEMS OF THE PORCUPINE DISTRICT

The Hollinger Mine

The Hollinger Gold Mines Co. owns 160 acres, four mining claims, in Tisdale township. The property is part of the original holdings of the Timmins-McMartin-Dunlap syndicate, which owns the Miller-Middleton claims on the west and the Dixon claims on the east of the Hollinger, as well as the controlling interest in this company.

The orebodies are in the form of quartz veins running across the claims in a northeasterly direction. There are several approximately parallel veins forming a vein system. The vein system is part of a larger fissured zone which extends across the Miller-Middleton, Hollinger, Dixon and McIntyre, claims.

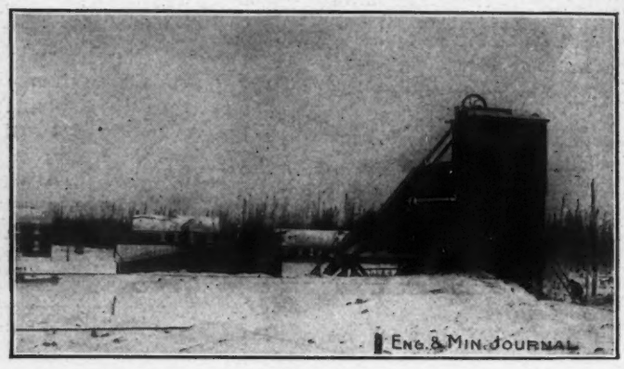
The wall rock is for the most part a finely crystalline gray schistose rock composed largely of sericite, carbonates and quartz. It contains numerous larger clear ragged grains of quartz occasionally in groups but usually in isolated grains. It is likely that some of these quartz grains were originally phenocrysts in the rock. Pyrite is a characteristic constituent generally occurring in well formed crystals. The rock is now almost entirely made up of secondary minerals; but was probably originally a quartz-porphyry. It was apparently acted upon by solutions carrying a large amount of carbonates, and by replacement has been almost completely changed. By pressure it has been made markedly schistose.

The quartz is much like that at the Dome, full of liquid inclusions and by strain shadows and granulation giving evidence of subjection to great pressure. The associated minerals are commonly pyrite, sericite and carbonates. Galena, sphalerite and chalcopyrite occur in small amounts. Recently scheelite has been found in the quartz. It has been found by P. A. Robbins that galena, and to a lesser degree sphalerite, is an indication of rich gold content. Mr. Robbins states that the schist walls of the vein do not usually carry profitable ore, except where contiguous to rich sections of the vein, and in such cases the schist seems to be more or less silicified, pointing to the silica-bearing solutions as having provided the gold. This observation at the Hollinger is probably true also of most of the other deposits. There are cases where the gold is not so limited to the quartz veins, but schist or ferrodolomite carrying gold are commonly impregnated with quartz in minute veinlets. Mr. Robbins has found the main vein to be an unbroken oreshoot over 1000 ft. long and from 2 to 20 ft. thick. The thick lenses have proved the richer.

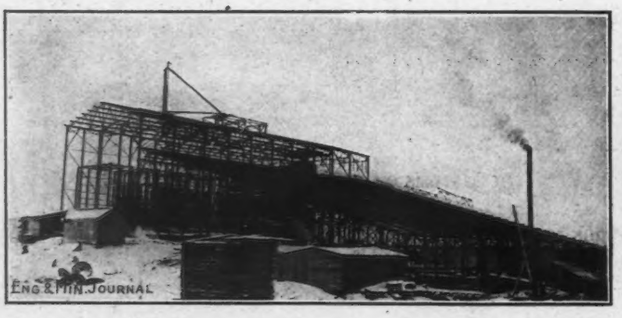
Mill tests made by A. G. Kirby have proved the ore to be in many respects similar to that at the Dome. By fine grinding a large percentage of the gold is

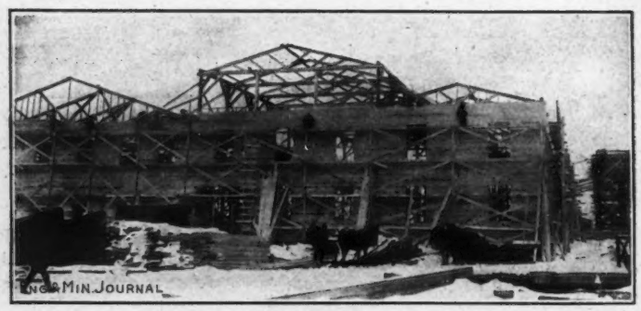
MILLER-MIDDLETON GOLD-QUARTZ VEIN

NODULAR MASSES OF QUARTZ IN GRAY SCHISTS, HOLLINGER MINE



BRICK CAMP BUILDINGS AND GOLDEN STAIRWAY SHAFT AT DOME MINE, PORCUPINE





DOME AND HOLLINGER MILLS IN DECEMBER, 1911, SHOWING DIFFERENT TYPES OF CONSTRUCTION

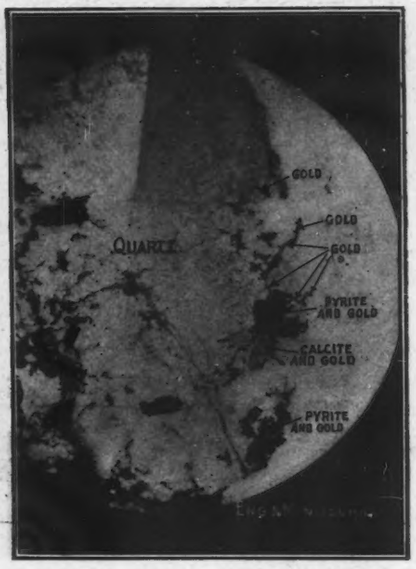
THE GOLDEN STAIRWAY VEIN AND CONGLOMERATE AT DOME MINE, PORCUPINE

readily recovered by amalgamation and the remainder is practically all recovered by cyanide treatment. The process decided upon is: Coarse grinding, stamping in cyanide solution, tube milling, concentration followed by amalgamation of concentrates and cyanide treatment of both gangue and concentrate residues.

The mill tests and microscopic examination of the ores from Dome and Hollinger mines agree very well. The ores are comparatively free from minerals that might be expected to consume much cyanide and the tests confirm the observation. The visible gold is generally closely associated with pyrite and the tests indicate that the exceedingly fine gold is in similar association. Much of the visible gold while near the pyrite is not in actual contact with it but inclosed entirely by quartz and ready amalgamation of such gold is to be expected. Some of the visible gold is entangled in pyrite so that it would only be caught on the plates after fine crushing. Some of the gold seen only with the aid of the microscope is in minute particles completely inclosed in pyrite and would not likely be saved without treatment by cyanide or some other solution. The tests indicate that the gold which is not visible is probably present in the same form as the visible gold, the difference being simply one of magnitude.

SERICITE SCHIST WALL ROCK AT HOLLINGER

QUARTZ VEINLET IN PYRITIC FERRODOLOMITE, REA MINE



NATIVE GOLD AND PYRITE IN QUARTZ, DOME MINE

QUARTZ VEINLET SEPARATED FROM FERRODOLOMITE BY CARBONATES, REA MINE

GRANULATED QUARTZ CHARACTERISTIC OF GOLD-BEARING PORTION, DOME MINE

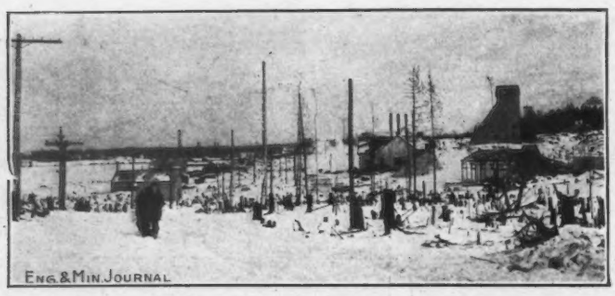
GOLD QUARTZ SHOWING A PYRITE CRYSTAL. TAKEN FROM NEAR CONTACT WITH GRAY SCHIST AT DOME

THE VIPOND MINE

The Porcupine Gold Mines Co. owns 360 acres in Tisdale township, and 80 acres in Mountjoy township. The Vipond group of three claims, southeast of the Hollinger.

There are two rich quartz veins about 100 ft. apart. One vein showing 4 to 6 ft. of quartz, mineralized schist and ferrodolomite is said, by H. P. Davis[1], to average at surface $30 per ton for a length of 600 ft. At the 100-ft. level the assays are said to average $23.10 per ton for a stoping width of 42 in., and a length of 320 ft. The second vein at surface

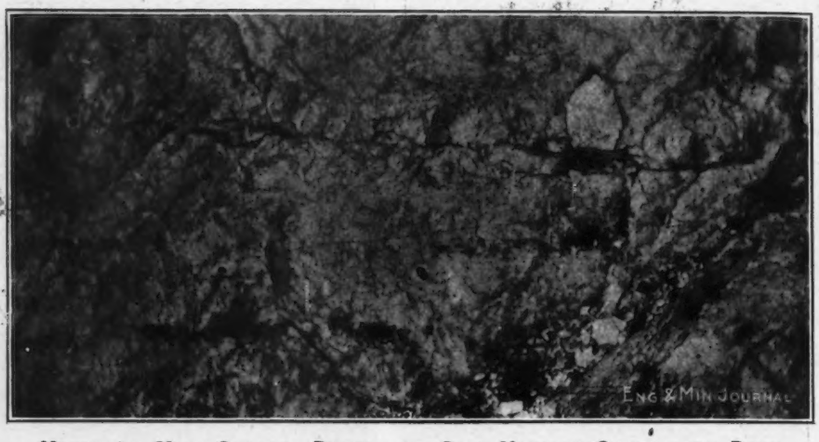
[1]Can. Min. Journ., Nov. 1, 1911.



McIntyre Mine, Porcupine, with Pearl Lake at Left

The Dome Extension Mine, Porcupine

White Quartz in Gray Sericite-quartz-Carbonate Schist, Hollinger Mine



Hollinger Vein Quartz. Pyrite and Gold Usually Occur with Dark Minerals in Fractures

The McIntyre Vein in Gray Schists

Quartz Veins Standing in Relief from Ferrodolomite, West Dome Mine

Quartz Veinlets in Ferrodolomite at West Dome Mine, Porcupine

showed a rich oreshoot 12 in. thick. Where cut at the 100-ft. level it showed 15 ft. of ore averaging $11.20 per ton. A mill with a capacity of about 100 tons per day is in process of erection.

The Rea Mine

The Rea Consolidated Gold Mines Co. owns 320 acres in Tisdale township. What is known as the main vein was discovered in May, 1910. The vein was stripped for 205 ft. and sampled every 5 ft. for a width of 42 in. The assays showed an average of $23.05 per ton. The average thickness at the surface is 6 feet.

The vein has a clear-cut boundary with the hanging-wall rock. The latter is a ferrodolomite which at the surface is rusty-weathered, and for a few feet disintegrated. Pyrite crystals are abundant. The carbonate grades off into a dark altered igneous rock impregnated with rusty-weathered ferrodolomite. The more altered parts are chiefly made up of chlorite and ferrodolomite with small amounts of quartz, sericite and black iron oxides. Parts of the rock show remnants of altered feldspars, some of which are apparently plagioclases ranging from oligoclase to andesine. The abundant chlorite scales and magnetite grains indicate that the rock originally contained a considerable percentage of ferromagnesian silicates; but there are none such now remaining. This chlorite-ferrodolomite rock is probably a fine-grained feldspathic igneous rock, most likely an acidic andesite or porphyrite, which has been permeated with and altered by solutions containing alkaline carbonates.

The quartz is milky white and vitreous. At the surface it shows rusty patches due to the alteration of contained crystals of pyrite and particles of ferrodolomite. As in nearly all the veins of the district there is little evidence of weathering a few feet below the surface. Numerous particles of coarse gold are visible, and one portion 12 in. wide along the north wall is for several feet remarkably rich. The wall is slickensided and vertically grooved. It is coated with an exceedingly thin greenish layer in which are numerous particles of coarse gold. In the quartz there are many minute dark streaks and much of the gold is found near these. The streaks are apparently secondary minerals which have filled in small crevices.

The quartz, like that at the Dome, Hollinger and Vipond has abundant fluid inclusions, and shows strain shadows and granulated particles. Small patches of ferrodolomite are scattered among the quartz grains. Two microscopically examined sections showing no gold are largely made up of coarse quartz grains 0.3 to 1 mm. in diameter with some carbonate. A section showing gold has much of the quartz in the form of fine grains, which have evidently been formed by the crushing of coarse grains. Tourmaline in brownish crystalline aggregates is common. Pyrite is abundant in the quartz and in the wall rocks.

In the latter part of 1910 development work was begun by two shafts 100 ft. apart. A shot-drill cut quartz showing coarse gold at a depth of 228 ft. From the eastern shaft at the 200-ft. level a crosscut was run to the vein, which was found to average for 200 ft. over $18 per ton. The vein where cut was 3 ft. thick. A section 110 ft. long, according to Mr. Rea[2], averaged $23.12. At the 300-ft. level the vein was found to be 38 ft. wide. A few samples were assayed and showed low gold content. Arrangements for more thorough sampling have recently been made and are now being carried out; and the shaft has been sunk to the 400-ft. level.

The McIntyre Mine

The McIntyre-Porcupine Mines Co. owns 148 acres, including claims adjoining Pearl and Gillies Lakes and a large portion of the bed of Pearl Lake. Prospecting in 1910 resulted in the uncovering of a number of quartz veins, two of which showed, in places, spectacular coarse gold. The wall rocks are gray schists made up largely of sericite, carbonates and quartz. The schists have probably been produced by the metamorphism of quartz-porphyry. The surface exposures show the rocks to be in places twisted, bent and broken. Faults displace the veins.

Five shafts have been sunk and good ore found in several veins. Some rich ore was encountered in workings at the 200-ft. level. Several holes were bored by shot and diamond drills, and ore found at depth under the lake. Development work has been pushed ahead rapidly and a 10-stamp mill has been started.

Other Properties

In the vicinity of the Hollinger and McIntyre the prospecting done during 1911 on several properties resulted satisfactorily. The Miller-Middleton, Dixon, Pearl Lake, Schumacher, Plenarum and McEnaney all found ore and have a reasonable chance of becoming profitable mines. The Miller-Middleton has an especially good surface showing. Drilling on the Pearl Lake property shows ore at a depth of about 1180 ft. Several of these properties have cut ore at a depth of about 100 ft. and some at 200 ft. The shafts as a rule do not follow the veins and no ore has been blocked out. The information that has been obtained, however, makes it appear likely that in addition to the known ore at the Hollinger and McIntyre there is a large amount of ore on the other properties in the gray-schist area in which the quartz veins on the McEnaney, Miller-Middleton, Hollinger, Dixon, McIntyre, Pearl Lake, Jupiter, Schumacher and Plenarum properties occur.

On the prospects in the vicinity of the Dome mine the development work done so far has not resulted as well as was expected. The Dome itself has exceeded expectations; but the surrounding mines have not yet developed any large orebodies. There are several good surface showings and further exploration may result in some good discoveries. In the northeast part of Tisdale township, the Crown Chartered, Dobie and Scottish Ontario have some good ore but no quantity of it is blocked out.

[2]Can. Min. Journ., Jan. 1, 1912.

Nevada Consolidated

The fiscal year of the Nevada Consolidated Copper Co. has been made to coincide with the calendar year, so that the last report covers a period of 15 months, ended Jan. 1, 1912. The ore reserves on Jan. 1, 1912, are 40,853,371 tons of 1.622% copper, as against 40,360,823 tons of 1.70% on Oct. 1, 1910. The production for the 15 months was 78,541,270 lb. of copper, which was delivered on the Atlantic seaboard, after allowing credits and also providing for depreciation and all other charges, at a cost of 6.97c. per lb. of fine copper. The selling price was 12½c. per pound.

The most important changes during the year were the substitution of California oil for coal at the Steptoe plant, and the trial of basic brick in the Steptoe converters, which led to the decision to replace the ordinary converters with the Peirce-Smith shells. The Veteran mine of the Cumberland Ely Copper Co., was reopened in December, 1911, after having been idle since July, 1909, owing to a strike of the miners.

Fifty-one churn-drill holes, aggregating 17,185 ft., were put down. Hole No. 76, in the Eureka pit, was carried down to a total depth of 680 ft., to see whether the 0.4% Cu rock was the original primary ore or a local deposit. The former is believed to be the case. During the 15 months, 3,249,140 cu.yd. of overburden has been removed, while up to Jan. 1, 1912, a total of 6,038,683 cu.yd. has been removed, and it is estimated that 12,649,000 cu.yd. remain to be removed. The average thickness of profitable ore in the various sections is as follows: Eureka, 190 ft.; Hecla, 280.3 ft.; Liberty, 193.3 ft. The average thickness of direct capping is: Eureka, 87.1 ft.; Hecla, 101.4 ft.; Liberty, 154.7 ft. Including proportion of New York expenses, the mining costs have been 15.7c. per dry ton, to which is added 15c. per ton on the Eureka orebody, and 22c. per ton on the Liberty orebody to cover stripping. Stripping costs have been reduced to 36.30c. per cubic yard.

During the year siliceous carbonate ore, to the extent of 205,795 dry tons, averaging 2.91% copper, was mined, of which

39,235 tons were crushed and delivered to the smeltery, and 166,560 tons put in storage to supply future needs of the converters and reverberatories. The cost of mining these carbonate ores has been 74.40c. per ton.

In the concentrator, results have been as follows: 3,338,242 tons of 1.80% Cu were concentrated 11.34: 1. The original silver and gold assays were 0.079 and 0.013 oz. per ton. Recoveries were: Cu, 67.59%; Ag, 45.92%; Au, 57.72%. The average copper in the concentrates is 13.80%, and the recovery of gold and silver 17.35c. per ton of the original ore.

Improved Richards Pulsator Classifier

The experience gained from the numerous installations of the Richards pulsator classifier has enabled the manufacturer within the last few years to improve its construction. All valves and gates are eliminated, and six spouts one to each compartment are provided, and for the great majority of ores to be classified these spouts are all situated on the same horizontal line. Altogether 19 parts requiring adjustment were eliminated, 13 of such parts being actually removed from the machine.

As a result of these changes only one adjustment is necessary to put the classifier in operation, namely, opening the main water-supply valve to the proper degree. Moreover, this simplified machine is now claimed to operate without change in adjustment, as well at one-tenth capacity as at full capacity, and to adapt itself automatically to sudden changes in amount of feed.

The type of classifier described herewith is known as the inverted type, for the reason that the slime is delivered from the first compartment, whereas in the common form of hydraulic classifier the coarsest pulp is delivered from the first compartment. The Richards classifier thus inverts the order of grading the pulp.

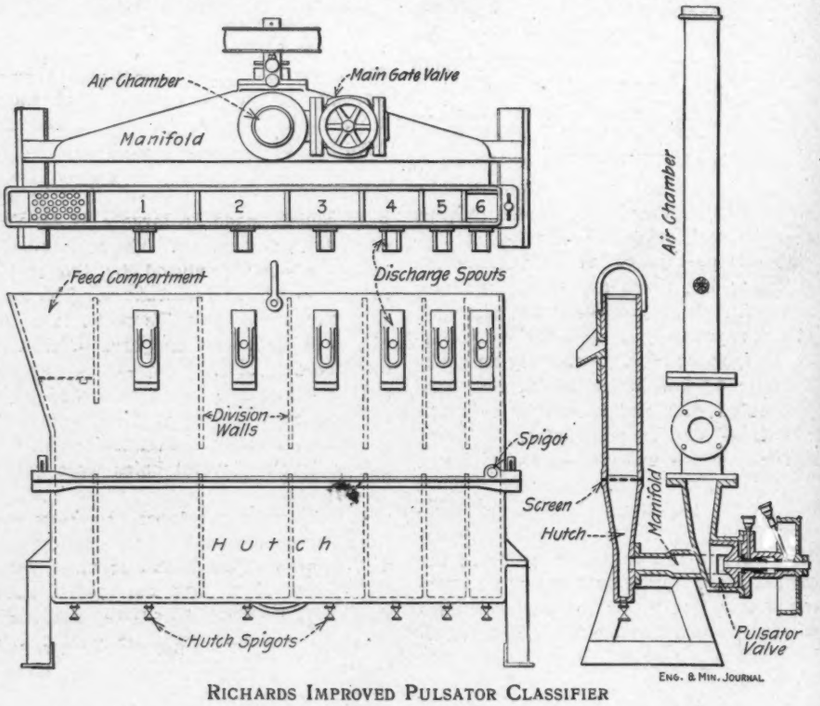
Referring to the accompanying engraving, it will be observed that the size of the classifying compartments varies from the largest at the feed end to the smallest at the opposite end of the classifier. The dimensions of each to give the desired capacity and proper gradation are a matter of calculation.

Hydraulic water enters the main gate valve at a pressure not to exceed 20 ft. head, passes through the pulsator valve, by which the pulsating effect which characterizes the machine is obtained, thence up to the screen and out of the discharge box. The water from the pulsator valve is distributed equally to each compartment by the manifold. Therefore, the amount of water flowing upward through the screen of each compartment is equal, but as the area of each compartment varies, there are six different velocities of ascending pulsating columns of water, that near the feed end being the lowest velocity and that at the opposite end being the highest.

The division walls above the screen do not reach down to the screen by about 4 in., except for a small section about ¾ in. high directly above the screen for pressing the screen and gaskets down tight on to the division walls beneath. The screen serves only to support the bed of ore and has no part in the classification other than distributing the flow of water uniformly throughout the area of each compartment.

The ore pulp enters the feed compartment, passes down to the screen and flows along the screen to the 4-in. opening. In its progress it is subjected in succession to the six different rising pulsating currents, the first compartment having the slowest current lifts out only the finest slime and carries it up to the discharge spout. The last compartment, having the fastest current lifts the heaviest particles.

Coarse mineral particles too heavy to rise with the current in the sixth compartment may be drawn out through the spigot provided in the sixth compartment just above the screen. It is stated that almost invariably the discharge from this spigot is excellent and clean concentrate. Particles of free minerals smaller than the openings in the screen will settle into the hutches, or compartments below the screen, where they may be drawn off by the spigot shown. A further claim is that when properly adjusted, the Richards pulsator classifier will discharge all the slime in the ore from the first two discharge spouts, the balance of the product discharged being absolutely free from slime. The Richards classifier occupies comparatively little space. The 170-ton capacity machine, giving six classified products, requires a floor space of only 3x5 ft. and weighs only 1600 lb. The mill head or height required is only 10 in. from the bottom of the feed launder to the bottom of discharge spouts.



RICHARDS IMPROVED PULSATOR CLASSIFIER

Beaver Consolidated Mines

The report of the Beaver Consolidated Mines, Ltd., for the year ended Feb. 29, 1912, shows that at its mine in the Cobalt district development work to the extent of 3515 ft. was done. The mine now has eight levels, and the main shaft is down 548 ft. The main shaft is to be sunk to 600 ft., where a station will be cut.

The year's production was 750,950 oz. of silver obtained from the following shipments: 199.22 tons of ore averaging 3320.2 oz.; 365.73 tons averaging 244.72 oz. The average price received was 54.7c. per oz.; the average cost of marketing, 3.37c. per oz.; the total average cost, 19.85c. per oz. Dividends, representing 8½% on the capitalization and amounting to nearly $170,000, were distributed.

A 50-ton concentrator to treat the dump and the low-grade ore from the mine was started on Feb. 22, 1912, and is reported to be giving satisfactory results. Provision was made so that by a small further expenditure the capacity can be brought up to 100 tons daily.

The company has its own mine inspector whose duty it is to examine the underground workings of the property twice daily and make written reports to the mine office.

Baltic Method of Mining—II

By Claude T. Rice

Before "caving" commences, the whole level is worked out up to within 35 ft. of the level above. Sorting follows the mining closely and any rock showing copper is considered to be ore. The level dry-walls are never less than 3½ ft. thick and are solidly packed.

In the Champion mine a level interval of 125 ft. was used, but this was soon reduced to 100 ft. and that is the level interval now used in the Trimountain and Baltic mines. As rock-lined mill holes are used, there is no real reason why this distance should not be increased to 125 ft., but it is thought that 100 ft. gives plenty of height to the stope. The principal reason for this is, that the ground in the top part of the block becomes heavy because the whole level is worked up to within about 35 ft. of the level above before caving commences.

Mining to Be Done Retreating

In the future it is planned to drift first to the boundary of the ore area or to the midway point between shafts, and then to carry on both stoping and caving retreating. In this way caving will commence earlier in the life of the stoping operations, and in any part of the block the level pillar will have less time to stand after it is undercut, than it does now before it is mined. As a result the ground will be in better condition than at present, and it will be more feasible to use a 125-ft. level interval. When mining is done all retreating, it is not unlikely that either the life of the mill hole or the dip of the load will finally determine the distance between levels, as it is highly desirable to keep these dry wall mills vertical. Under present conditions it is necessary to keep an entire level open for seven or eight years in an outside block served by only one shaft, and for about half that time in a block worked from two shafts. Mills 70 ft. high give little trouble, even when exposed as long as that to the wear and tear of the ore going through them and to the weight upon them. With a shorter length of life, made possible by a retreating method of mining, they should stand well, even when carried to a height of 100 feet.

The timber covering of the dry walls on the level, commences to rot before the walls show signs of failing, and to lengthen the life of this timber the fungus growth is swept off occasionally, and in the shaft the timbers are sprinkled either by hand or by turning water from the foot wall back behind the timbers on the hanging side of the shaft.

Car, Chute and Dry Walls, Baltic Copper Mine, Michigan

The former practice on opening a level was to cut out the lode from wall to wall as the shaft pillar, which is always left at least 50 ft. wide, was passed. Later it was deemed better to drive the drift only 14 to 16 ft. wide, in this way reaching the boundary sooner.

After trying both systems it has been found still better to cut the load out from wall to wall, where of mineable grade, as fast as the level is advanced. There are several reasons for this: First, owing to the poor rock broken down with the ore, the boundaries are not reached before it becomes desirable to put up a cutting-out stope so as to permit the building of dry walls, behind which the poor rock can be placed. If the drift is as wide as the lode, the tracks can be cleared more quickly; again, the wider the workings, the easier it is to follow the irregularities of the hanging wall, which has to be done in opening work or the miners would soon not know whether they were crosscutting or drifting. With a wide working, the holes also break better, and the muck from the last round interferes less with drilling. When poor rock is encountered, the drift stope is drawn to an ordinary 7x7-ft. drift.

In small drifts and crosscuts a corner cut is taken next the hanging wall, this now being preferred by the miners to the cut drawn off the bottom, which was formerly used. In the wide drift the ground is broken with a side cut, and the ore slabbed out from floor to roof. The usual practice is to blast on each shift. A floor of hardwood planks is sometimes laid before the ground is blasted, but generally this is not done.

Shovelers do the Tramming

The shovelers, who do the tramming and are called trammers in the Lake mines, since they tram as well as shovel, get out from 13 to 15 tons per shift, according to the distance that the rock has to be trammed. About 35 ft. of drilling, or five 7-ft. holes per shift is considered good work for a 2-man machine in these drifts, although since the 1-man machines are being tried, many of the large machines are drilling about 40 ft. per shift.

A 9-ft. drill is the longest that is used in these drifts. In the 16x7-ft. drifts formerly driven, an advance of from 55 to 65 ft. per month was made with one 2-man machine drilling on each shift. The cost of breaking the ground in the large drifts varying from 10x7 ft. to 16x7 ft. is as follows: Labor drilling, $4.04 per ft.; explosives, 97c. per ft.; total cost of breaking, $5.01 per foot.

Most of the drilling is now done with 3⅛-in., Rand drills, but for the last two years the company has been experimenting with 1-man machines. Most of this work has been done in drifts, but some of the Leyners have been tried in stopes. Besides the No. 8 water Leyners, 2½-in. Sullivan and 2¾-in. butterfly valve, Ingersoll-Sargeant 1-man drills have also been tried, but the water Leyner is more favorably looked upon. At the Trimountain mine an underground repair shop is maintained, and any repairs, such as can be made at a bench fitted with a vise and ordinary tools, are made without sending the drill to surface. This shop is placed in an old crosscut and the machines are tested on a permanently rigged-up bar before being sent out again; this shop has been a profitable installation.

Wages

Unlike the practice at most of the copper country mines, the drilling is done on day's pay and not on contract, excepting drifting and shaft sinking. The method of stoping makes it impossible to do drilling on contract unless it is paid for by the foot, and this is not especially desirable in these mines. The men work the usual hours in this district. Miners work five full 9-hr. shifts on night shift and 5½ shifts on day shift, while the shovelers work five full shifts and a 7-hr. shift on Saturday. The number of hours worked in a week is about the same as in a Western mine where 8-hr. shifts are worked every day of the week, with one shift lost every two weeks on change Sunday.

The following wages are paid for underground labor on 9-hr. shifts: Machine men, $2.50; pickers and shovelers, $2.25; dumpers, $2.25; pipe and trackmen, $2.35; timbermen, $2.40; wallers, $2.25. Surface men on 10-hr. shifts receive $1.83. Hoisting engineers on 8-hr. shifts are paid $2.30 per shift, and oilers, who are generally boys, receive about $35 per month. Miners on contract receive on an average from $3 to $3.25 per shift, the shaftmen getting the most. Pit bosses, generally known as shift bosses, receive $3 per day, and under-captains from $3.50 to $4 per day.

Timber, Explosives and Lights

The timber used underground is generally maple, with some ash and beech. This timber costs from $1.30 to $1.50 per 14-ft. log between 14 and 18 in. in diameter at the small end; 10-in. flat timber, with not less than an 8-in. face, costs from 10 to 12c. per running ft.; lagging, which is generally split cedar thick enough to be the equivalent of a 4-in. round pole, is 16 ft. long and costs about $12 per cord, 4 ft. high, 8 ft. long and the length of the lagging through.

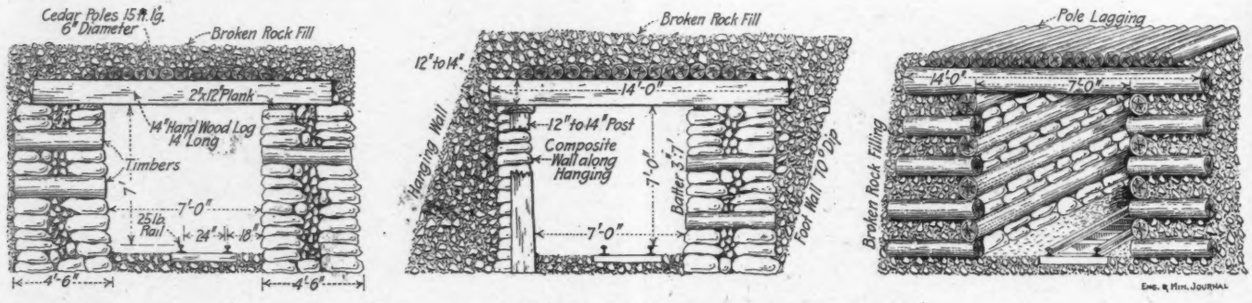
Thirty per cent. ammonia dynamite is used principally in both development and regular stoping, although a little 40% is sometimes used in development. Lately, 30% Red Cross dynamite, which has a low freezing point, has been used and is well liked; in the future it is planned to use principally Red Cross dynamite, thus doing away with the necessity of thawing, which has been done by the miners in a special thawing box. At present 5X caps are generally used, but 6X caps are being introduced and will be used in the future. The open price for 30% dynamite, in the district, is $10 per 100 lb. Excepting a few of the timbermen, pipemen and bosses, who use acetylene lamps, the men underground use Sunshine grease in lamps, this costing about 1c. per ton of rock. This lighting cost amounts to about as much per ton as the timber used. The mines are well ventilated, and the smoke given off by the grease lamps and the greater consumption of oxygen, compared with candles, is not important. In a few places the men use candles owing to bad ventilation, but as a rule ventilation is good and the men are able to work at full efficiency.

Fuel and Pumping

The cost of coal delivered at the mine is about $3.25 per ton, and the cost of power is figured at about $60 per hp. per year. A pressure of 75 lb. per sq.in. is carried on the compressors. Most of the water made by these mines comes in near the surface and is caught on the upper levels, so there is little pumping to be done. Large sumps, locally called forks, are used, and the pumps are run intermittently. The main pumping is done by electric pumps, but both electric and air-driven auxiliaries are used. Four-stage centrifugals and geared plunger pumps are used for the main pumping, but all the later installations are plunger pumps as they are more efficient in these mines. The mine water in the district is peculiarly salty, this quality increasing somewhat with depth.

Dry-Walling on the Levels

If poor rock is encountered when the drift has been extended some distance from the shaft, it is customary to return to the shaft pillar and to start a cutting-out stope. This stope is carried from 14 to 16 ft. high above the rails, in order that there will be from 5 to 7 ft. of open space above the timbers that are placed as a cover on top of the dry walls. When the ground has been cut out of this height from wall to wall, and the shovelers have worked out the ore for some distance ahead, the building of the dry walls commences. This building is done by crews of two men who use double-hand, trimming hammers to break off irregular corners from the boulders, if necessary to make them fit in the wall.



Dry-wall Drifts at Baltic Copper Mine, Michigan

As the shovelers work out the ore from the cutting-out stope, they lay aside the larger pieces of poor rock, so that the wallers can get them easily for use in the outer facing of the dry walls.

These walls, as shown in the illustrations, are built about 4½ ft. wide at the base and about 4 ft. wide at the top. The larger pieces are placed in the face next the drift, and the smaller boulders in the face next the filling. In walls of average thickness the boulders of the two faces frequently lap over each other, thus binding the two facing walls together; when they do not touch each other, the smaller pieces that are placed in between are arranged to tie the inside ends of the boulders together. An accompanying illustration shows this. Pieces of old blocking and broken stulls are occasionally built in to tie the two facing walls together, where, owing to the width of the lode, the walls are carried up wider than the average width given here; the timber pieces, however, are in no way essential to the solidity of the dry walls. The boulders used are

generally from 18 to 30 in. long, but many are only 14 in.; consequently in the wider walls a considerable center filling of smaller pieces has to be used. This center filling is built in such a manner as to bind the facing walls to the inside filling, and the solidity of the walls is due largely to this avoidance of open spaces. Care is taken to break joints in the rocks of the two facing walls so that there will be no planes of weakness extending through the walls. Small openings between the boulders are chinked with small pieces of rock.

Height of Walls

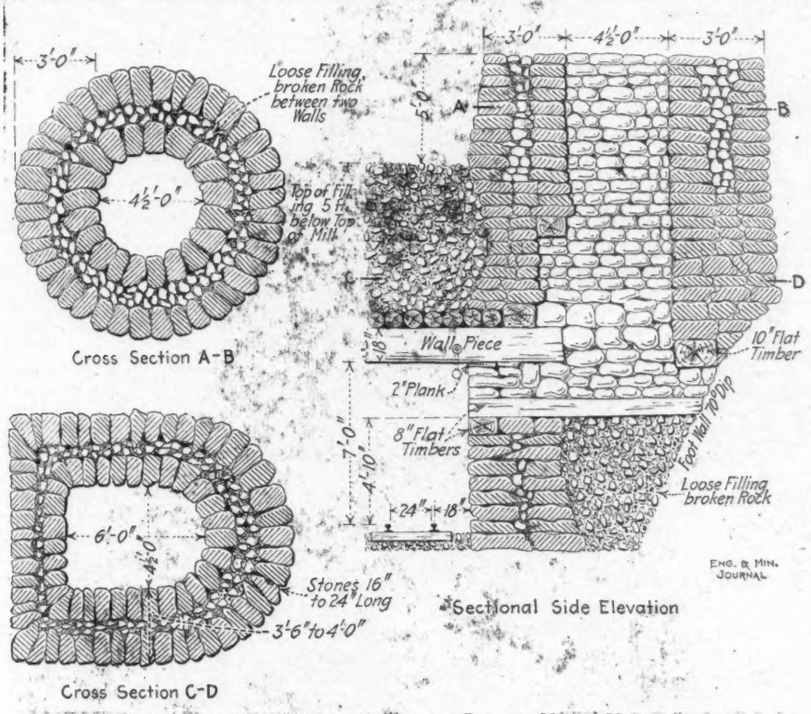
These walls are carried 7 ft. high and are built with 7 ft. between them at the bottom, and a batter to the side next the drift of 3 or 4 in. in their height. Because of the double track that is carried for some distance from the shaft, the walls here are 9 ft. apart, but as soon as possible they are drawn to 7 ft. The walls present an admirably smooth face on the drift side and run along in a surprisingly straight course for walls that are built without lines to aid the workmen.

The men in charge of this work are generally Italians or Austrians who have had some experience in working with stone in the old country; in no sense, however, are they stone masons when they commence to do this work underground, although after a year of such experience they often leave the mine and secure employment as stone masons in other places. Indeed the dry walls underground at the Baltic mine are as excellent a type of such walls as I have ever seen, either in this country or in Mexico. Owing to the tendency of the rock to break into tabular shape, little facing is required to obtain the smooth sides shown in the accompanying illustration, which are typical of the walls. Two men are able to raise up an area of about 30 sq.ft. of wall in a 9-hr. shift. When the poor rock is at some distance from the wall, a low truck is used, and in building the top part the men work from a temporary stage.

Headboard Distributes the Weight

The top of the wall is made as smooth as the sides facing the drift, and a 2x12-in. plank is laid along the top of the inside face, to distribute the weight of the logs used to cover the drift. This prevents the cover pieces from cutting down into the walls as the weight comes on them. While these planks, of course, rot, they last long enough to serve their purpose. It is only in the early life of the walls, when the weight is coming on, that any solicitude is felt for them. It is customary often to put in an occasional plank along the face of the wall with a spreader piece from a similar plank along the other wall to help resistance to any side thrust, while the first few cuts are being taken from the back of the stope. A temporary strut is sometimes placed under the walls to keep them from being broken while the first load of ore is being blasted down on the timber covering of the drift.

The wall pieces, or covering, are hardwood logs, 14 ft. long, although formerly 16-ft. logs were used. They are placed with about an equal hold on each wall, and at about 3½-ft. centers, the latter varying with the size of the logs which are from 14 to 18 in. in diameter. The largest of these are saved and used where a mill hole is to be put up to serve the stope. Over these wall pieces and running lengthwise with the drift, a tight covering of 16-ft., split cedar lagging, or of hard wood poles, is put on, these having a diameter of 4 in. The lagging generally rests on five logs.



Dry-wall Mill Hole at Baltic Copper Mine, Michigan

Occasional Composite Walls

Where the lode is not wide enough to permit the use of two 4-ft. walls, a wall of usual width is placed along the foot-wall side, as the most weight comes there. In case a wall 3½ ft. wide cannot be placed along the hanging, the covering logs at that side are carried on a series of legs or posts, as a dry wall less than 3½ ft. wide is not strong. A continuous headboard, consisting of 6- or 8-in. flat timbers or a 2-in. plank, is carried along the top of these posts, the wall pieces resting on the headboard but just over the post. The headboard is nailed to the top of the posts to keep the latter from shifting and in this way the former acts as a brace against side swing, as well as a binder to keep the posts from slipping. A narrow wall of poor rock is placed between the posts, and behind that there is thrown as much poor rock as the hanging wall will permit. Such a wall, shown in the illustrations stands well in narrow places, as in the narrow part of the lode the weight of the filling is soon carried principally by the foot-wall side of the drift. A composite wall such as this is being used quite generally at the Trimountain mine, where the stopes are narrower than at the Baltic and at the Champion, and even when there is sometimes sufficient space for a 4-ft. wall; they stand sufficiently well and are somewhat cheaper than the regulation dry wall. In wide parts of the lode a fixed wall is necessary to withstand the side thrusts of the filling, while the first stoping is in progress.

Where sufficient desirable poor rock cannot be easily obtained, the walls are made by building logs into 3-sided pig-sties, with pieces of poor rock chinked in between the logs of the outer face to keep them from crushing when the weight comes on them. The inside of this crib is filled with poor rock, which takes the weight, while the outer logs serve principally to hold the filling in place; the short cross logs bind the facing logs to the fillings so that the weight will not push them out. It is merely a matter of cost that determines the type of wall to be used; such a pig-sty, with poor rock chinking stands well until the logs commence to rot, which is not within six or seven years owing to the good ventilation.

Repairing the Walls

These dry walls stand remarkably well, and even after bulging out 6 in. they give no signs of falling; some of the dry walls that were placed in the mine 10 years ago are still standing. In case that any part of a wall does not stand well no trouble is experienced in removing the bad portion and replacing it with new walls, using an occasional piece of timber to tie the inside face to the mass of the wall; the filling becomes so consolidated inside of a year that it will not run readily unless broken into. In this repairing of the walls, the timber of the roof is carried on a false set, placed to catch the unsupported ends.

The average cost of these dry walls is about $2.50 per ft. of double wall 4½ ft. wide, not including the covering of wall pieces and poles. With a heaving pole, enough of this covering is hoisted, to cover 50 or 60 ft. of wall, and this is rolled back on top of the planked pieces of the walls, to the proper places. The labor of putting the timber in place is small, as it is straight lifting without cutting or framing. As mentioned before, the mill holes are also dry-walled, and I believe that this is the first time in the United States that dry walling has been used for mill holes; I understand, however, that in German mines, dry-wall mills are not uncommon in places.

Dry Wall Mill Holes

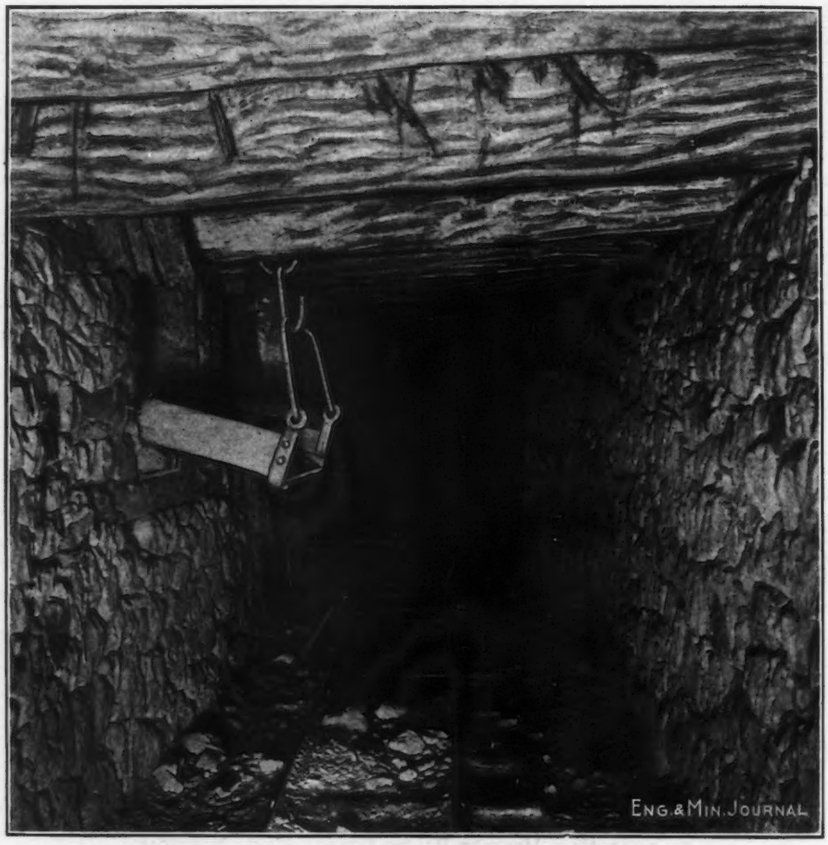
The mill holes, as shown, are carried up with two walls and a center core of loose material. The inner wall is built of the larger pieces of poor rock, as this is the wall that has to withstand the wear and tear of the rock falling down through the mills, and therefore is most apt to be knocked out. Most of the thrust of the filling is taken up by the walls carried up to form the outer ring of the mill. The central filling of loose material gives the walls sufficient width to withstand the shock of blasting when the walls are carried above the mill, and also permits the outer wall to adjust itself to withstand the pressure of the filling, without injuring the inner wall.

The walls all start from a 6- or 8-in. flat timber, for the sides, while the back piece is a 10-in. flat timber, as are also the two brow pieces. The mills are started with a horseshoe shape that extends up about 7 or 8 ft. from the bottom, and at this point the mill is contracted by springing the front wall from another brow piece, so that it has a circular section, about 4½ ft. in diameter, this being large enough to permit the stope cars to be taken up and down.

Rocks about 16 in. long are used in building the inside walls, and normally the latter are about 3 ft. thick. A greater thickness is necessary, however, where the walls have to be carried above the filling. When this is done the bottom of the wall is increased to a thickness of 4 or 4½ ft. and is brought in again to 3 ft. at the top, which extends about 5 ft. above the filling. This enlarging of the top of the mill is shown in the illustrations. In every instance, in order to protect the wood from which the walls are started, the boulders at the bottom are started with an overhang or overlap, on the timbers of about 4 in. The mouth of the mill hole is about 4 ft. 4 in. wide and 3 ft. high from the lip to the brow piece, and the lip piece is an 8-in. flat timber about 8 ft. long, built into the level dry-wall. The apron gate of the chute is fastened to the lip timber with eye-bolts, and a lever consisting of a cedar pole fastened by a clevis to the wall piece next to the mill hole, is used to raise and lower the apron gate. If the mouth of the mill is too wide for the apron gate, the former is contracted by nailing 2-in. planks to the wall pieces and side timbers, thus preventing the fine dirt from running out around the sides.

Interval Between Mill Holes

The distance between mill holes was formerly about 50 ft., but this has been increased until at present it is about 70 ft. for the newer holes. This distance, however, is variable, and depends somewhat on the nature of the ground at the point where the position of the next mill hole would naturally occur. It is difficult to start the back wall of the mill from the foot wall of the lode; it is better also to start from the filling than from a timber piece carried on the side walls. Owing to the manner of mining the level pillar, the first mill is started at the edge of the shaft pillar, and the next one but 25 ft. away, the first mill serving as a manway to get into the stope while the back is being mined. All these mill holes at times serve as manways and to carry air pipes, as well as for ordinary mills to get out the ore. Ladders are carried up through them by springing the upper ladder from the one below it with a pair of S-hooks and overlapping the ladders until three or four 12-ft. ladders have been raised in this manner. It is then customary at the Champion mine to place a sollar at the end of every two ladders, this sollar being carried on temporary sprags in crevices in the walls. These mill holes generally give little trouble during the life of the stope, but occasionally holes are knocked in the inner walls. These are easily repaired, either by patching with timber or with new boulders. If the patch is properly made it will last as well as the original wall.



Dry-walled Level, Champion Copper Mine, Michigan

Three Feet of Mill Built Per Day

In building these mills the wallers work in pairs. The amount that can be put up in a day depends largely on the availability of poor rock and the height of the mill above the filling; the exact amount that a pair of men will build in a shift is difficult to estimate, as no direct account has been kept of this, but it amounts to about 3 ft. of standard mill for a crew of two men. The best and most accurate way of treating the dry-walling cost at these properties is to give the total cost of keeping the mine workings open. These figures for the Baltic mine for the year 1910, when 781,419 tons of ore were sent to the mill, are given below in detail.

COST OF KEEPING BALTIC MINE OPEN IN 1910

	Cents per ton of ore stamped
Labor, timbermen	3.2
Labor, walling	4.97
Labor, spreading filling in stopes	2.3
Total labor	10.47
Material	1.2
Total cost of keeping mine open	11.67

When the mills were first used a piece of sheet iron 4 ft. long and 18 in. wide was used to protect the lip timber from wear at the bottom of the mill; this is still used at the Trimountain, but at the Baltic and Champion it is no longer used and the apron gate is fastened directly to the lip piece with no attempt to protect the timber from wear; in case the holes are cut out by the rock, the gates can be fastened to the side timbers of the mills by straps, the gate and lever being removed from one mill to another when necessary.

Commencement of Stoping

In most cases the space back of the dry walls is filled with poor rock from the cutting-out stope and the drifts, before the walls are covered over; in case there is not sufficient rock to fill in tightly behind both walls, the space behind the wall on the hanging side of the drift is filled, and enough poor rock is usually secured from the lode to fill the space behind the wall on the foot side. This is possible because the cutting-in for each breast in the first slice of the stope is done along the hanging side.

The loading of the timbers of the dry wall with dirt, is done by carrying ahead a flat breast drilled with water holes; this is considered easier on the timbers than would be the case if upper holes were used. This breast is carried about 6 ft. high and rocks from the broken ore, which forms a pile about 9 ft. high on account of the increase in bulk, runs far enough ahead to cover the timbers under the next cut; these cuts are drilled with 8-ft. drills as finishers, and the holes will square only about 6 or 6½ ft. ahead. The holes of the first slice are drilled strong and care is taken not to overload them with explosives.

The ore from the first slice or two taken off a stope, is worked through the lagging into the cars without the use of the mills, because the poor rock is piled along the walls as long as possible. After the timbers are well covered with waste, the mill holes are resorted to for the ore, cars being used between mills. The track for these cars has a gage of 3 ft. 1 in. and is laid with 16-lb. rails. The cars are made with a turntable and are pivoted on the truck, so that they may be used in building out the filling into the stopes, whenever the width of the latter and the shortage of filling make it necessary to cut into the walls. These stope cars hold about a ton and are made with a long, narrow, low body; in order to get these cars through the mill holes, a portable tripod, from which is suspended a pulley, is placed on the top of the mill. The moving of these cars is done by the timbermen, who work generally in gangs of five, and the changing of pipes from one manway to another is done by the pipemen. The miners do only the drilling.

Sorting the Ore

The sorting is done by special men who in time becomes expert in detecting small particles of copper, and the work is so arranged that these pickers have to display no discrimination in regard to what is waste and what is not. It is merely necessary to see copper in the rock, and if this is done, such rock goes into the mill for ore. While it would sometimes seem that some of these pieces might better be left in the stope for filling, it often happens that there is some copper, too small to be seen by the eye, accompanying the other copper, and that the rock will pay for itself even when little copper can be seen. In the case of rock of such size that it has to be shoveled, the bosses tell the pickers whether it shall go into the mill for ore or be used for filling. The decision depends on the general character of the ore in that part of the stope, but the point is that the sorters have this determined for them. The larger boulders are broken with hammers, if they show no copper, and the small pieces are reexamined.

On an average the pickers will put about 13 tons of ore per shift into the mill, but this depends upon the condition of the pile and the proximity of the mill. The character of a pile in regard to the proportion of poor rock and ore, is judged by the trammer boss, or picker boss as he is sometimes called, on his first trip through the mine in the morning. These bosses become expert in judging these piles and when they go through again in the afternoon, they can tell approximately whether the pickers have done a fair shift's work.

Drilling in the Stopes

The miners work ahead on the pile of broken ore and the pickers follow them. Two-man, 3⅛-in., Rand drills are used in all the stopes, excepting a few at the Trimountain, where 1-man, water Leyners are being experimented with. The Leyner drills are doing good work in the stopes and it is probable that they will soon replace the others at the Copper Range mines. A face, 6 to 9 ft. high to the slice is carried and the filling is generally kept within 9 ft. of the back. The breast is usually carried along in a single slice, but occasionally, where the back is high above the filling, a second slice is necessary before the breast can be advanced again. To carry a 9-ft. breast in the Champion mine requires generally two flat, dry holes and three flat, water holes in a row, as a burden of only about 22 in. can be placed on the toe of a hole in the stopes of that mine. The width of the lode determines the number of holes necessary to break across the breast. At the Trimountain mine, where the lode in the stope at present averages about 20 ft. in width, two set-ups and four rows of holes are necessary to break a slice across the lode; in the Baltic and Champion mines it requires three set-ups and six rows of holes to break a breast from 25 to 30 ft. wide.

Ground Breaks Easiest in Baltic Mine

With a breast 6 ft. high, such as is commonly carried in the Trimountain mine, two water holes and one flat, dry hole to a row are required; in the Baltic mine, which. in some ways, contains the easiest breaking ground of the three mines, such a row of holes will often bring a breast 8 ft. high. Considering the depth of the breast to be the direction of the depth of the holes and the vertical thickness of the breast to be its height, these holes will break out a breast averaging 6½ or 7 ft. deep. The height of the breast that is taken depends entirely upon the distance that the filling is kept from the roof of the stope; the higher the back from the filling, the thicker must be the slice broken down to secure enough muck to set up on to drill the next face.

Because of this variation in height and also to avoid the carrying about of a quantity of blocking in the stopes, the miners use a post which sets up on a separate jacking block. The miners generally rig up with a 6-ft. post but they are also provided with a 7- and 9-ft. post; 5-, 8-, 10- and even 4-ft. posts are also provided but do not constitute the regular equipment that accompanies a machine. A shift's drilling consists of five or six 7-ft. holes and these are

loaded with from five to six sticks of 30% dynamite. The average tonnage broken per machine, including those on development work and filling, is from 750 to 850 tons of stamp rock per month; the amount of filling that comes from the lode and that which must be obtained from the foot wall is known only approximately, but it is probable that for each machine in a stope over 1200 tons of ore and poor rock is broken per month.

Obtaining Filling for Stopes

It is roughly estimated that about half the filling comes from the lode and half from the walls. At the Trimountain mine all the poor rock is obtained from the foot wall, since this is where the copper that has been missed is most likely to be found, and also because more ground can be broken by the holes in the next slice by undercutting the ore along the foot wall. In the Baltic and Champion mines, because of the West lode, the practice is to take a slab off of the foot and if that does not show copper, to crosscut into the hanging and prospect the West lode. If copper is found the pocket is stoped out and the rock for filling is broken from the West lode in the hopes that this work will disclose more copper; the filling is trammed in stope cars and spread out in the main stope. In case that no copper is found, the practice is generally to open a waste stope near the Baltic lode with a foot sloping at about 45°, so that the broken rock will run to the cars itself.

As the slice is advanced, the mill holes are covered over before the ore is blasted down on them. As the pickers work ahead and get the ore off from the top of the next mill, the ladderway and air pipes are gradually carried ahead to a mill near the breast. Where the back stands well, it is carried rather flat, but in bad ground it is broken with a considerable arch. This arched roof is characteristic of the Baltic stopes.

Cutting Down Bad Ground

Owing to the fact that the miners are made to pay especial attention to the back, it is often an hour before they are ready to drill the first hole on a shift. In case barring will not bring down a slab, a gad with a string tied to it is used, so that it will not be lost in the pile of muck that follows. If this, too, fails, a dangerous slab is often shot down with a double-jacked hole. Strong temporary stages for this work are made by burying ladders in the boulders to a depth of 3 ft. and placing planks between ladders, the latter having been placed in the form of a triangle. The machine men in the stope generally devote the Saturday half-shift to cleaning down the back and making things safe for the next week. Rarely is any drilling done in a stope on Saturday. If the miners get well ahead of the pickers, and waste rock is needed in the stope, the miners set to work obtaining filling from the walls until the pickers have caught up again.

Flat Holes Used

In this way the stope is worked up by a series of horizontal cuts taken off the roof by flat holes; these flat holes break more ground than upper holes would, and they also leave the back in a safer condition because the upper holes tend to loosen the back. With machines it is also considered healthier for the men in a stope to drill as many water holes as possible. The breast is carried from the shaft pillar to the end of the stope and is then worked out again, until finally a bar of poor ground is encountered. In case the stope is short of poor rock, filling may be obtained by stoping poor ground in the Baltic lode itself, but a drift is always driven through these bars to test them thoroughly. Such a bar usually ends a stope temporarily but as the stope is carried up, the ore will almost always be found to extend farther and farther over the poor rock until the patch of poor ground drops out and the stope joins again with the one beyond. A smaller number of these bars are left in the Baltic than in the Champion mine, where sometimes, when wide, they give considerable trouble while caving the top part of the stope. The stope is worked up to within about 35 ft. of the level above, and if the latter has been completely worked out in that part of the ground, the so-called "caving" process commences.

(To be concluded.)

Old Method of Mining with Timbered Levels, Champion Mine

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18,772 — COBALT-NICKEL SPEISS — Verarbeitung einer gerösteten bleireichen Kobalt-Nickelspeise. Barth. (Metallurgie, Mar. 22, 1912; 18 pp., illus.) Method of working a roasted cobalt-nickel speiss rich in lead. 40c.

18773 — FERROSILICON — Ferrosilizium-Explosionen und ihre vermutlichen Ursachen. A. von Gumberz. (Stahl u. Eisen, Feb. 15, 1912; 3¾ pp.) Ferrosilicon explosions and their probable causes. 40c.

18,774—SLAG DISPOSAL PLANT of the Granby Consolidated Mining, Smelting and Power Co., at Grand Forks. C. M. Avery. (The Labor Saver, Apr., 1912; 1¼ pp., illus.)

18,775 — SMELTER SMOKE — Experiments with the Thiogen Process. Frank L. Wilson. (Min. and Sci. Press, Apr. 6, 1912; 1½ pp., illus.) 20c.

18,776—SMELTER SMOKE—Progress of Smelter Smoke Control in California. A. H. Martin. (Min. Sci., Apr. 4, 1912; 1¾ pp., illus.) Baghouse system of the Mammoth Copper Co.; a cooling pipe arrangement for warm weather; the Reed, Cottrell and Young processes. 20c.

18,777—SOLUTION and Its Importance. Harry C. Jones. (Eng. and Min. Journ., Apr. 6, 1912; 4⅓ pp.) 20c.

18,778—SOLUTION—Electrolytic Dissociation and Solvation. Harry C. Jones. (Eng. and Min. Journ., Mar. 30, 1912; 4 pp.) 20c.

18,779—SOLUTION—Further Studies in Solution. Harry C. Jones. (Eng. and Min. Journ., Apr. 20, 1912; 4¾ pp.) 20c.

18,780—VALUATION — Notes on the Valuation of Ores and Minerals and on Metallurgical Calculations. George T. Holloway. (Bull. I. M. M., No. 90, Mar. 14, 1912; 16 pp.)

18,781—WELDING—Acetylene Welding and Welding Schools in Europe. J. M. Morehead. (Eng. News, Apr. 18, 1912; 2 pp., illus.) 20c.

18,782 — WELDING — Das Schweissen mittels Elektrizität und Gassauerstoff. Hempel. (Oest. Zeit. f. B. u. H., Mar. 23, 1912; 1 p.) Welding by means of electricity and gaseous oxygen. 40c.

MINING AND METALLURGICAL MACHINERY

18,783 — AERIAL TRAMWAY — Construction of Argentine Tram. C. A. Tupper. (Eng. and Min. Journ., Apr. 6, 1912; 2⅓ pp.) Describes the construction of the aërial tramway operated by the government of Argentina from Chilecito to the Famatina group of mines. 20c.

18,784—AERIAL TRAMWAY—Discussion of J. Balfour Sneddon's Description of the Aerial Ropeway from the Shale Mines to the Oil Works at Oakbank, Mid-Calder. (Trans. Min. Inst. of Scotland, Feb. 15, 1912; 7¼ pp., illus.)

18,785—AERIAL TRAMWAY of the Real del Monte Company, in Pachuca. C. W. Van Law. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 9 pp., illus.)

18,786—AERIAL TRAMWAY—Transporte Aero de Gran Capacidad en Bilbao. (Revista Minera, Apr. 1, 1912; 1½ pp.) 40c.

18,787—AIR COMPRESSOR ECONOMY in Driving the Catskill Aqueduct Tunnel, New York City. F. A. Halleck. (Mine and Quarry, Mar., 1912; 14 pp., illus.) 20c.

18,788—AIR COMPRESSORS—Centrifugal Compressors. Louis C. Lowenstein. (Gen. Elec. Rev., Mar. and Apr., 1912; 18 pp., illus.) 60c.

18,789—CONVEYORS—A Study of Mechanical Conveyors—II. Lincoln D. Moss. (School of Mines Quart., April, 1912; 26 pp., illus.) 60c.

18,790—ELECTRIC FURNACES—Elektrischer Widerstandsofen für beliebige Badlängen. F. Thomas. (Metallurgie, Mar. 8, 1912; 2¼ pp., illus.) 40c.

18,791—EXCAVATORS—Moderne Trockenbagger im Dienste der oberschlesischen Montanindustrie. (B. u. H. Rundschau, Jan. 20, 1912; 1 p., illus.)

18,792—GAS PRODUCERS—The Gasification of Fuel. IV, Constructive Suggestions for Future Progress in Producer Design. C. E. Lucke. (Eng. Mag., Apr., 1912; 11 pp., illus.) 40c.

18,793—HAULAGE—A New Type of Gravity Plane. J. J. Smith. (Eng. and Min. Journ., Apr. 13, 1912; 7 pp., illus.) 20c.

18,794—HOISTING—Safety Catch for Cage. H. L. Botsford. (Eng. and Min. Journ., Mar. 30, 1912; 1 p., illus.) 20c.

18,795—HOISTING—The Walker Overwind Prevention Gear. John Paul. (Eng. and Min. Journ., Apr. 13, 1912; ½ p., illus.) 20c.

18,796—HOISTING ENGINE—Versuche an einer elektrisch betriebenen Hauptschachtförderanlage mit Schwungradausgleich. Wille. (Zeit. d. Ver. D. I., Mar. 2, 1912; 11 pp., illus.) Tests on an electrically driven main hoisting engine with equalization of the balance wheel.

18,797—HOISTING ENGINES — Elektrisch betriebene Fördermaschinen. Recktenwald. (B. u. H. Rundschau, Mar. 20, 1912; 2¼ pp.)

18,798—HOISTS—Electrical Mine Hoists and Their Control. C. A. Tupper. (Min. and Eng. Wld., Mar. 30, 1912; 2 pp., illus.) 20c.

18,799—LOCOMOTIVE—The Otto Internal Combustion Locomotive. J. B. Van Brussel. (Eng. and Min. Journ., Mar. 30, 1912; ⅔ p.) 20c.

18,800—LOCOMOTIVES—Vergleichende Untersuchungen an Grubenlokomotiven. Bütow and Dobbelstein. (Glückauf, Mar. 23 and 30, 1912; 17 pp., illus.) Comparative investigations on mine locomotives. To be continued. 60c.

18,801—PUMP—German Development of the Hydraulic Ram. (Journ. Elec., Power and Gas, Apr. 13, 1912; ½ p.) 20c.

18,802—PUMP—The Adaption of the Centrifugal Pump to Chemical Problems. F. G. Wheeler. (Journ. Ind. and Eng. Chem., Apr., 1812; 9 pp., illus.) 60c.

18,803—PUMPS—High-Speed Turbine Pumps. J. W. Rogers. (Cassier's Mag., Apr., 1912; 14 pp., illus.) Continuation of article previously indexed. 40c.

18,804—TURBINE TESTING—Elements of Turbine Testing. Robert Sibley. (Journ. Elec., Power and Gas, Mar. 16, 1912; 2¼ pp., illus.) 20c.

SAMPLING AND ASSAYING

18,805—CYANIDE BULLION—Cadmium and Nickel in Cyanide Bullion. F. P. Dewey. (Eng. and Min. Journ., Apr. 13, 1912; ¾ p.) 20c.

18,806—GAS ANALYSIS APPARATUS, New Forms of. G. A. Burrell. (Journ. Ind. and Eng. Chem., Apr., 1912; 5 pp., illus.) 60c.

18,807—LEAD ARSENATES—A Short Method for the Determination of Soluble Arsenic in Commercial Lead Arsenates. B. E. Curry and T. O. Smith. (Journ. Ind. and Eng. Chem., Mar., 1912; 2 pp.) 60c.

18,808—LEAD, NICKEL AND ZINC—The Estimation of Lead, Nickel and Zinc by Precipitation as Oxalates and Titration with Potassium Permanganate. H. L. Ward. (Am. Journ. of Sci., Apr., 1912; 5 pp.) 40c.

18,809—PLATINUM—The Direct Determination of Small Amounts of Platinum in Ores and Bullion. Frederic P. Dewey. (Bull. A. I. M. E., Apr., 1912; 4 pp.) 40c.

18,810 — POTASSIUM PERMANGANATE SOLUTION—Standardization of Potassium Permanganate Solution by Sodium Oxalate. R. S. McBride. (Journ. Am. Chem. Soc., Apr., 1912; 23 pp.) 60c.

18,811—RAPID METHODS of Technical Analysis. Frank D. Aller. (Colo. School of Mines Mag., Apr., 1912; 1¼ pp.) Continuation of article previously indexed; analysis of copper and lead slags. 40c.

18,812—SAMPLE CRUSHER—A Simple Crusher for Samplers. George J. Bancroft. (Min. Mag., Mar., 1912; 1¼ pp., illus.) 40c.

18,813—UNITED STATES ASSAY OFFICES; Methods of Operation. (Min. and Eng. Wld., Feb. 24, 1912; 2 pp.) 20c.

18,814—VALUATION OF ORE RESERVES—A Graphic Method for Facilitating Valuation of Ore Reserves. James M. Platt. (Informes y Memorias del Instituto Mexicano de Minas y Metalurgia, Ano II, No. 6, 1911; 4 pp., illus.)

18,815—VANADIUM—A Rapid Method for the Determination of Vanadium in Steels, Ores, Etc., Based on Its Quantitative Inclusion by the Phosphomolybdate Precipitate. J. R. Cain and J. C. Hostetter. (Journ. Ind. and Eng. Chem., Apr., 1912; 6 pp., illus.)

INDUSTRIAL CHEMISTRY

18,816 — AMMONIA — Geschäftsbericht der Deutschen Ammoniak-Verkaufvereinigung über das Jahr 1911. (Glückauf, Mar. 23, 1912; 1¼ pp.) Abstract of the annual report of the German ammonia selling union for the year 1911.

18,817 — LITHOPONE — Bemerkungen über die Lithoponefabrikation und ihre mechanische Vervollkommung. Nagel. (Zeit. f. angew. Chemie, Mar. 29, 1912; 3 pp., illus.) Notes on the manufacture of lithopone and its mechanical improvement. 40c.

18,818—SULPHURIC ACID MANUFACTURE in Tennessee. Wilbur A. Nelson. (Min. Sci., Feb. 8, 1912; 2½ pp., illus.) Development of an important byproduct industry as an incident to copper smelting. 20c.

18,819—WATER PURIFICATION and Its Application to Industrial Uses. H. Royal-Dawson (Chem. Trade Journ., Jan. 20, 1912; 2 pp.) 40c.

18,820 — WATER TREATMENT — The "Luminator" Treatment of Water. Henry B. Lake. (Journ. Soc. Chem. Ind., Jan. 31, 1912; 2½ pp.)

18,821—WATER TREATMENT—Ueber die Reinigung und Enthärtung des Wassers durch Permutit. Kolb. (Chem. Ztg., Dec. 16, 21 and 23, 1911; 4½ pp.) On the purification of water by permutite.

18,822—WHITE-LEAD INDUSTRY in the United States, with an Appendix on the Lead-Oxide Industry. Alice Hamilton. (Bull. U. S. Bureau of Labor, July, 1911; 71 pp.)

MATERIALS OF CONSTRUCTION

18,823—CEMENT—Eisenportlandzement im Vergleich zu Portlandzement. H. Passow. (Stahl u. Eisen, Mar. 21, 1912; 3½ pp.) 40c.

18,824—CEMENT—The Effect of High-Pressure Steam on the Crushing Strength of Portland Cement Mortar and Concrete. Rudolph J. Wig. (Tech. Paper No. 5, Bureau of Standards, Washington, D. C.)

18,825—CEMENT PLANT—The New Tidewater Portland Cement Plant at Union Bridge, Maryland. (Eng. Rec., Apr. 13, 1912; 3 pp., illus.) 20c.

18,826—CEMENT PLANT—The Plant of the Crescent Portland Cement Company. W. B. Ruggles. (Cement Age Dec., 1911; 3¼ pp., illus.) 20c.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

W. de L. Benedict has removed his office from 43 Cedar Street to 19 Cedar Street, New York.

C. A. Dawley, consulting engineer, has removed his office to the West Street Building, New York.

L. C. Trent, of the L. C. Trent Engineering Co., of Los Angeles, has been visiting San Francisco.

J. B. Hastings, general manager of the Yellow Jacket Mining Co., near Hailey, Idaho, is in New York.

Col. E. A. Wall, of Salt Lake City, Utah, is in the East, under treatment for an affection of the eyes.

E. M. Rabb, of Denver, Colo., is ill, following an operation for appendicitis on Apr. 23, in St. Luke's Hospital.

C. H. Macnutt, general manager of the Poderosa Mining Co., of Chile, expects to be in London at the end of May.

Frederick G. Clapp, of Pittsburg, has been in Monongalia County, W. Va., making some geological examinations.

A. L. Queneau, of Philadelphia, sailed for Belgium on Apr. 27, where he expects to be during the remainder of this year.

D. L. H. Forbes, Toronto, Ont., has been appointed consulting engineer for the Trethewey Silver-Cobalt Mine, Ltd., at Cobalt.

C. W. Purington has been appointed chief engineer of the Pioneer Co. of Siberia, Ltd., which has its principal office in London.

R. E. Cavnah left Denver, Colo., Mar. 31 to take the position of superintendent of the Eagle Mining Co. at Edwardsburg, Idaho.

Prof. Edwin C. Holden, of the University of Wisconsin, intends to make a professional trip to Montana, Idaho and Utah in June and July.

Hoxie & Goodloe, consulting engineers, announce that their New York office has been removed from 50 Church to 50 East Forty-first Street.

B. C. Moise, recently appointed secretary of the National Tube Co., Pittsburg, has also been appointed a director, succeeding J. D. Culbertson, deceased.

Dr. Richard Borchers, Duisburg-Ruhrort, Germany, is in the United States for the purpose of making a special study of loading and unloading machinery.

E. M. Hamilton has returned to Los Angeles from Taviche, Oaxaca, Mexico, and is now on his way to England, where he expects to remain for three months.

Harold C. E. Spence, of the International Mining Syndicate, Ltd., has returned to Nova Scotia after a year spent in Europe on business, and will go to New Mexico shortly.

Gerald Lovell, general manager for Canada of the Bewick Moreing Co., of London, was recently in the Manitou Lake gold area, examining mining properties for the company.

Henry B. Kaeding is visiting the Panama Canal on a vacation. He will be in New Orleans about May 1 to purchase a new mill for the Siempre Viva Mining Co., of Nicaragua.

Julius A. Lewisohn has been chosen president of the Kerr Lake Mining Co., Cobalt, Ont., in place of Edward Steindler, deceased. William G. Nickerson, of Boston, has been chosen a director.

W. S. Keith returned recently to San Francisco from an examination of the Helester mine, in Placer Co., Calif., and has left for Last Chance, Calif., to resume operations at the Home Ticket drift gravel mine.

L. H. Burnett has been appointed assistant to President A. C. Dinkey of the Carnegie Steel Co., Pittsburg, and in addition to other duties, will have charge of the accident and relief bureaus, succeeding Geo. K. Preston, resigned.

Cecil P. Poole, who has been the junior editor-in-chief of *Power*, for the past seven years, has severed his connection with that paper and will engage May 1 in consulting engineering in Atlanta, Ga., in partnership with Lamar Lyndon, of New York. The firm will operate as the southern branch of Mr. Lyndon's New York office, which will continue as heretofore. The Atlanta office will be conducted by Mr. Poole. For the past 12 years Mr. Poole has made a special study of electrical machine construction and of gas-power engineering. He is widely known as a writer on both subjects and is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

OBITUARY

Jacob E. Friend, president of the Nordberg Manufacturing Co., Milwaukee, Wis., died Apr. 20 in Italy, while on a trip for his health.

Henry T. Bragdon died at Oakland, Calif., Apr. 21, from a pistol shot inflicted by himself. He was 65 years old, and was born in Lynn, Mass. He went to California 35 years ago and was actively engaged in mining in California and Nevada, and was at one time president of the Goldfield Stock Exchange. He made his home in that town for several years. Two years ago he moved to Oakland. Ill health and a nervous breakdown are attributed as cause for his act.

John Pattinson, a distinguished chemist and inventor of the Pattinson process of desilverizing lead, died at Newcastle, England, Mar. 12, aged 84 years. Notwithstanding his age he was active until a few days before his death. Mr. Pattinson was vice-president of the Chemical Society; an original fellow of the Institute, on whose council he served, and of which he was a censor; vice-president of the Society of Public Analysts; original member of the Iron & Steel Institute. He was one of the founders of the Society of Chemical Industry.

George W. Grayson died at San Francisco, Apr. 20, aged 83 years. He went to California in 1849, returned to his home in Kentucky for a short visit and made a second journey across the plains in 1851. He has been engaged in mining in California, Idaho and Nevada since that time. He was associated with J. B. Haggin in Idaho, and in the bonanza days of the Comstock with E. J. Baldwin, Archie Borland and James R. Keene. Besides his mining investments, Mr. Grayson was one of the prominent cattle men of the West. He established the firm of Grayson, Owen & Co., although he later sold out his interests in that company. He has lived a great part of the time in the last few years on his ranch in Nevada, his business affairs in San Francisco being handled by his son-in-law, W. C. Ralston. Mr. Grayson was one of the members of the original board of trustees of the California State Mining Bureau. He left an estate valued at about $700,000, consisting chiefly of mining stock and real estate in California, Nevada and Washington. He was a member of the Association of California Pioneers.

Societies and Technical Schools

American Society of Mechanical Engineers—The date for the spring meeting has been changed. It will be held May 28-31, at Cleveland, Ohio.

American Electrochemical Society — The recent election of officers resulted as follows: President, W. Lash Miller; vice-presidents, F. A. Lidbury, E. R. Taylor, William Brady; managers, E. F. Roeber, L. E. Saunders and L. Kahlenberg.

American Society of Mechanical Engineers—Honorary membership in the society was conferred on Dr. Rudolph Diesel, Apr. 30, in the auditorium of the Engineering Societies Building, New York. This was followed, under the auspices of the Gas Power Section, by an illustrated address by Dr. Diesel on "The Development of the Diesel Engine."

University of Illinois—Work has been commenced upon the construction of the new Ceramics and Mining Engineering laboratories. These buildings are to form a part of the group of engineering buildings to be located upon ground which has recently been acquired by the University. The contracts for the new Transportation Building and the Locomotive Testing laboratory will soon be let.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 24—The State Anti-Débris Association recently made a report of investigation of the dredging fields. The investigation was chiefly confined to the Feather River district in Butte County. On Honcut Creek, a tributary to the Feather, the inspection disclosed the flotation pond of Kentucky No. 1 dredge to be well land-locked. The Honcut dredge was found not so safe for the creek although the flotation pond was land-locked. Directions were given to the superintendent to provide further safeguards. The mining camps on Yuba River in the vicinity of Scales, Camptonville and Brandy City were also inspected. Recently the State Conservation Commission sent out an agent to investigate the probability of dredges operating on lands well adapted to agriculture. These investigations have evidently disclosed little disposition for dredge operators to disregard the laws. It has been the plan of most dredging companies to conduct operations in such a manner as to conserve the waters and leave the land in condition to be reclaimed readily for agricultural purposes. The Natomas Consolidated is constructing levees for the protection of the reclaimed dredging lands belonging to the company. The drag-line excavators are being removed to the Sacramento River to begin the construction of a levee from Sacramento to Vernon, 22 miles upstream. The drag-line excavator prepares the way for the suction dredges by throwing up dikes of soil, 100 ft. apart. These suction dredges are being built by the Yuba Construction Co. at Marysville.

The final settlement of the Coleman-Lightner-Utica litigation at Angels Camp in Calaveras County, while regarded as a victory for James V. Coleman, owner of the Angels mine, is none the less a benefit to the entire camp. This litigation has been pending for years and the controversy was expensive and a detriment to the camp. The disputes arose over conflicts between townsite and mining titles, extralateral rights and geological differences. There is a present suit pending between the Kennedy Extension Mining Co. and the Argonaut Gold Mining Co. in Amador County, which is purely a question of apex. The suits to quiet title to the Keystone and Wildman mines in Amador County have engaged the courts for some time and have retarded the reopening of these old mines which in former years were large producers. These properties and the Lincoln were taken over by W. J. McGee, C. R. Downs and others who are in a position to develop them. There is a prospect now that the creditors will be settled with and the cases taken out of the courts, after which development will probably proceed without further interruption. There is a brighter outlook for improvement in both Calaveras and Amador Counties with the end of the litigation in sight.

The taking of evidence in the case of the United States *vs.* the Southern Pacific Co., involving the posession of large tracts of land in the Elk Hills is in progress at Los Angeles before Leo Longley, a special examiner of the Department of Justice. The counsel for the railroad company has not cross-examined the witnesses closely and it is evident that the chief defense in the suits will be that the land was not of mineral character in the strict meaning of the Federal act. It was shown that the oil expert of the Southern Pacific knew and stated that the geological conditions in the Elk Hills indicated the presence of oil, and that development work was ordered in that district. It was shown by one witness that as early as 1874, he had prospected in that district and found indications of oil. This is the first of a series of suits to be brought by the government which will involve several hundred thousand acres of land, lying chiefly in the San Joaquin valley.

Butte

Apr. 25—John D. Ryan, president of the Amalgamated Copper Co., accompanied by a party of Eastern bankers, has been making an inspection of conditions in the West, and particularly in Montana. They spent a day in Great Falls looking over the smeltery and water-power sites, and arrived in Butte, Apr. 25, for an inspection of the mines. While in Great Falls, Mr. Ryan made the announcement that a complete reconstruction of the Boston & Montana smeltery at that place, at a cost of $2,500,000, has been ordered, the work to be commenced with the delivery of the structural steel by the Eastern mills, which will be within three or four months. The plans and specifications have been accepted, and the new plant will be entirely of steel and concrete, situated principally on the present smeltery site and upon considerable additional ground along the river on the east. It is calculated that the new plant will be finished in about a year, and, in the meantime, the old smeltery will be kept running and the output probably increased. Although the present plant is an excellent one, it was constructed 22 years ago, and to keep up with the strides made in the reduction of the costs of smelting, the company has decided that in the long run large savings will be effected by constructing an entirely new plant, modern in every detail. Situated at a point where almost unlimited water power is available, it is probable that the new smeltery will be second to none in the country in economy of results.

The Garnet placer-mining district, in Granite County, is coming to the front as a mining center again, and a number of properties are being developed. Placer gold was discovered there in 1865, and since then it has produced nearly $10,000,000 in gold. In recent years the source of the placer gold has been discovered in a number of fissure veins, and development work on them has shown a number of excellent sulphide deposits containing gold. The district is on Elk Mountain, near the boundary line of Granite and Powell Counties, and includes the mining camps of Garnet, Top O'Deep and Coloma. On the Magone and Anderson group of claims, operated by Col. A. B. Peake, active development work is being done on the 350-ft. level.

Denver

Apr. 25—In addition to the 50,000 tons of steel ordered by the Hill lines, already chronicled in the JOURNAL, the Harriman lines have given an order to the Minnequa plant of the Colorado Fuel & Iron Co., at Pueblo, for 50,000 tons.

Manager M. W. Cooley, of the Uintah Ry., running from Mack, on the Rio Grande Western, to the gilsonite deposits near Dragon, Utah, has announced that he will broad-gage that line, and build a series of tunnels northward from the Book cliffs. The longest of these will be 5000 ft., and it is said that $1,000,000 will be expended on the entire work.

The electric power business of the Cripple Creek district has been consolidated under one head, the H. M. Byllesby Co., of Chicago, having taken over the Consolidated Electric Co., of Cañon City, and the Pueblo Light & Traction Co. This power company will now furnish ample and continuous service in that field and has made full arrangements to do so. There is a double transmission line from Victor to Cañon City, and when the line from Cañon City to a point on the Pueblo-Victor lines is connected, it

will mean that three lines of wires will be running into the district from the three power plants, all tied together so that it will be impossible for the district to be deprived of power.

The Portland mill has installed a 300-hp. motor; the Isabella mine has started its electric motors, which have now been leased to Morris Brothers, of Victor, who will treat the tailings from the mill dumps in summer and the mine dump in winter, and the Blue Flag mill, which is being increased in capacity, will install additional motors. Most of the large mines are changing from steam to electricity, the new company agreeing to reduce the cost one-half.

The transaction is now closed by which the old Hill pyritic smeltery, at Ouray, passes to the Brown Mountain Smelting Co., of which A. C. McCall, of Denver, is president, and Col. B. Crawford, manager. J. M. Head, a banker of Jefferson, Iowa, is said to be interested. The company owns the Indiana mine, near Ironton, in the Red Mountain district.

Salt Lake City

Apr. 25—Attention has been called recently to the iron ores of Iron County, Utah, by testimony given before the Senate Committee in investigating the United States Steel Corporation. The estimated amount of 1,000,000,000 tons is far in excess of the tonnage now developed. The report of the U. S. Geological Survey, published in 1908, gives a tonnage of 40,000,000 tons, which is obtained by multiplying the known area by the depth given by drill holes, pits and erosion sections. This is undoubtedly low, for most of the pits are bottomed in ore, and the probability of large deposits extending under the limestone must be considered. Conservative engineers have placed the amount at from 200,000,000 to 300,000,000 tons.

The average composition of the ore is iron, 56%; silica, 7%; phosphorus, 0.20%; lime and magnesia, 4%, with small amounts of copper, sulphur, manganese and titanium, but not in sufficient amounts to be injurious. The ore occurs as a replacement of limestone near its contact with intrusive andesite and also in fissures in the andesite. The deposits are due to contact metamorphism, as are most of the iron ores of western America.

Experiments made some years ago show that coke, sufficiently strong to bear the burden in an 80-ft. furnace, can be made from certain Utah coals by crushing before coking. Limestone of sufficient purity occurs in many parts of the state, notwithstanding the statement made before the Senate Committee to the contrary. High freight and labor rates in connection with a limited demand for the product are important factors to be considered at the present time, but this ore will undoubtedly be utilized in the future.

Negaunee, Mich.

Apr. 27—Iron ore shipments have started from the three Michigan ranges. Pocket and stockpile ore is being forwarded from the mines to Escanaba, on Lake Michigan, the first port to load ore; Marquette and Ashland, on Lake Superior, are also receiving ore, and Lake boats are now passing the Soo canal. A night crew is at work on the Chicago & Northwestern Ry. ore docks, at Escanaba, and the Chicago, Milwaukee & St. Paul R.R. has a good-sized day crew; ore is no longer giving trouble from freezing in the docks. The Menominee Range is the most active in shipping, a number of mines there having started as early as possible, including the old Hemlock mine, of Pickands, Mather & Co., at Amasa, which was the last mine to stop shipping last season. In the Gwinn district of the Marquette Range, the Stegmiller mine, of the Oliver Iron Mining Co., is shipping stockpile ore loaded by steam-shovel, and the Stephenson mine, of the Cleveland-Cliffs Iron Co., is shipping from pockets. In the Cascade district, the Empire mine, of Oglebay, Norton & Co., which has been closed all winter, is preparing to open, and Frank Klinglund, formerly of Iron River, has been transferred to take charge.

Shaft sinking has been commenced at the Lucky Star property, at Negaunee, owned jointly by the Breitung-Kaufman interests and the Cleveland-Cliffs Iron Co., and to be operated by the former, who have a controlling share. The tract of about 50 acres was the subject of litigation between the two organizations, which was settled last winter by a compromise. About 5,000,000 tons of soft ore have been indicated between depths of 900 and 1300 ft., by four diamond-drill holes; the land is in the center of a group of producing mines, including the Negaunee, of the Cleveland-Cliffs Iron Co. on the north, the Queen group, of the Oliver company, on the southeast, and the Breitung-Hematite and Mary Charlotte mines, of the Breitung interests, on the southwest. The shaft, which is near the center of the tract, is 14 ft. 10 in. by 12 ft. 2 in., will be wood lined and will have four compartments. From diamond drilling, which has been carried on at the shaft site, about 85 ft. of overburden is anticipated.

Cobalt

Apr. 25—The arrest of Kalil Farah in connection with the flotation of the Big Pete Canadian mines, has caused discussion throughout the mining districts of northern Ontario. The company owned 25 claims in the Larder Lake section, and in 1908 sold about $400,000 worth of stock in France at from $2 to $2.50 per share. The company was a wildcat flotation, and the prospectus was replete with misleading information. The French shareholders, represented in this country by Count de Forez, a Paris lawyer, charge Farah, the president of the company, with the issuing of the fraudulent prospectus and with wrongfully converting $10,000 of the company's money.

There is a revival of activity in the Elk Lake district, and to a lesser extent in Gowganda, as a result of the commencement of railroad construction. The following mines have plants in operation: Moose Horn, Beacon, Hitchcock, Donaldson, Regal, Cobalt-Frontenac and Bateese. A Montreal syndicate has purchased two claims in Smyth township from Frank Westcott and will develop them. At Gowganda a rich find at the 250-ft. level of the Miller Lake-O'Brien is reported. The Mann has run into rich ore at the 90-ft. level and will soon make another shipment. The Millerett will begin shipping when the roads will permit. The Hudson Bay, at Hanging Stone, is taking out high-grade ore from the 80-ft. level. All indications point to an active season.

Porcupine

Apr. 25—Considerable interest has been aroused over the suspension of the brokerage firm of J. Thomas Reinhardt, largely interested in three Porcupine flotations: Porcupine Central, Porcupine Southern, and Porcupine Northern. Porcupine Central was the first stock on the market, but it did not take well. Due to a considerable short interest the price was advanced to $5.50 per share. Several of the brokers refused to settle, and there were legal proceedings last autumn in Toronto and New York. After the suspension some of the stocks dropped to about 7c. per share. These properties never had anything especially to recommend them and so far nothing except the assessment work has been done. On some of them the overburden is 40 ft. deep so that it is impossible to prospect them by trenching.

The Pearl Lake Mining Co. has made an assignment for its creditors. In a circular mailed to the shareholders, the president states that the company still has 251,000 shares in the treasury, but the state of the market is such that it has been impossible to sell treasury stock to meet current liabilities. He states that he expects soon to be in a position to pay off all claims.

A syndicate headed by D. Lorne McGibbon and H. Holgate, both of Montreal, has arranged to take over the nearly completed power plant at Waiwaitin Falls, on the Mattagami River, for supplying electricity to the Porcupine camp. The Dome interests are understood to be represented in the enterprise. The carrying out of the project will enable the Dome and other companies to dispense with individual power plants except as auxiliaries.

The Mining News

The Current History of Mining

Alaska

Alaska-Treadwell—During March, the mill crushed 64,120 tons of ore, yielding $159,782 gross and net $58,613. Operating expenses were $95,183; construction $5985; yield per ton, $2.51; development 1072 feet.

Alaska-Juneau—The tunnel on the property in Silver Bow Basin is expected to be finished by Mar. 1 1914. The company is erecting wharves and a 150-stamp mill on the water front, two miles below Juneau, and these will be connected with the mines by the 7200 ft. tunnel mentioned above. Electric locomotives will be used in the tunnel.

Porcupine—The management of this gold mine, 38 miles from Haines, states that steady production will be maintained from now on.

Cliff—The March output of this gold mine was worth $36,000.

Fairbanks District

Daly Bench—Smith Bros., operating this property on Eva Creek, are still in the rich gravel, which they opened recently. One pan from the drift yielded $300 and pans yielding from $50 to $80 are quite common. Delegate Wickersham is one of the owners.

Homestake—The tunnel is now in 590 ft. from the portal. The vein is still quite a distance ahead, although several rich stringers have been cut, which are too narrow to work.

Arizona

Gila County

Inspiration Consolidated—W. H. Aldridge, who is visiting the mines, states that the two 3-compartment, steel-concrete working shafts will be started soon and that contracts will soon be let for the grading and excavation work for the 7500-ton concentrator and the necessary railroads. Representatives of manufacturers of concentrating machinery are at the mines, including A. R. Wilfley, E. J. O'Connel, of the Deister Concentrator Co., C. I. Glassbrook, of the Mine & Smelter Supply Co., and P. H. Craven, representing the Craven slime machine. Emil Deister, formerly of the Deister Concentrator Co., is conducting tests on his new slime-treating machine at the Miami and Old Dominion concentrators.

Southwestern Miami—Churn-drill hole No. 3 has been discontinued at 780 ft.; the tools were lost in the hole and could not be recovered on account of caving. The hole is reported to have passed through 285 ft. of chalcocite-bearing schist. Holes 4, 5 and 6 are 380,330 and 240 ft. deep respectively and have not yet passed through the Gila conglomerate.

Arizona Commercial—A small force of men is at work repairing the Copper Hill shaft. The work has progressed below the 300-ft. level.

Superior & Boston—Development work continues on the 1200-ft. level with two crosscuts and a drift. Mining has been resumed on a sublevel below the sixth level and the company has commenced shipping ore to the Old Dominion smeltery.

Old Dominion—The third section of the concrete lining of the Kingdon shaft has been completed, making a total distance of 525 ft. from the collar. The fourth section will be started 155 ft. below this point.

Uneeda—C. W. Cross is developing this group of 18 claims in the Pinal Mountains, 4½ miles south of Globe. The shaft is being deepened and is now down 140 feet.

Copper Reef—Men and teams are hauling machinery and supplies from San Carlos to the mine, a distance of 15 miles. The new equipment includes an engine and compressor. These will be erected at the portal of the California tunnel, after which the driving of this tunnel will be continued.

Sho Me—Drifting on the vein on the 90-ft. level continues. The vein carries soft red hematite and some native copper. The footwall schist carries pyrite and chalcopyrite.

Gibson—The mine has shipped another car of chalcopyrite ore to the Old Dominion smeltery. Ore is reported in the face of the drift on the Pasquale vein on the fourth level. Stoping is being done above this level.

Black Warrior—Lessees are shipping three cars per week of copper silicate ore to the El Paso smeltery. The company is doing some repair work on the lower levels. Nine men are employed at present.

Santa Cruz County

Augusta—This mine, owned by Neil McDonald, from which several thousand tons of ore were shipped two years ago, is now being unwatered by A. G. Fraser for purposes of examination.

Little Johnny—This group has been bonded by Thomas Fraser, associated with Bisbee men.

Eureka—Shipments will begin from this mine under bond to B. F. Lindsly, the latter part of this month. Good ore is now being taken out, running high in silver, showing much wire silver.

California

Amador County

Central Eureka—The orebody opened on the 2700-ft. level is believed to be the west vein found in the South Eureka.

Plymouth Consolidated—The unwatering of the Pacific shaft is progressing. The purpose is to sink 500 ft. below the old workings and to prospect the mine at that level and above. This will make a total depth of 1950 feet.

South Amador—The orebody recently opened on the footwall of the 500-ft. level shows a width of 45 ft. at two points tapped by crosscuts. Drifting is in progress. A mill will be installed if the mine continues to show well.

Calaveras County

Lightner—All of the suits resulting from the Coleman-Lightner litigation have been settled and dismissed and the present owner is the Lightner Gold Mining Co.

Big Fraction—A 5-ft. vein of quartz has been disclosed in this mine at Mokelumne Hill. If development warrants, a stamp mill will be installed for treating the low-grade ore.

Fresno County

An organization has been effected by the property owners on the west side of the Coalinga district to drill a test well in the paraffin sand first discovered in well No. 80 of the Standard. An assessment of $4 per acre will be paid by the owners of the lands, and if the well proves successful and profitable, the profits are to be distributed *pro rata*. This is a close corporation. Twenty acres of land have been donated to the company by A. P. May. It is believed that oil-bearing sand will be found below the brown shale. The average depth of the territory is 2000 ft. The purpose is to drill this well 3800 ft. if necessary.

Inyo County

Four Metals Co.—A plan has been evolved for the settlement of the debts of this company which will insure the creditors about 90c. on the dollar. This will enable the leasers of the mine to

continue operation but it is reported that the stockholders will lose their investment.

KERN COUNTY

American Oilfields Co.—A 55,000-bbl. steel tank was struck by lightning on Apr. 9. The oil caught fire, but was extinguished with a loss of only part of the contents. The fire was overcome by blankets soaked in water and placed around the edge of the roof of the buildings covering the tanks. Steam was then forced into the tanks smothering the flames.

MODOC COUNTY

Dispatches from the High Grade camp state that snow is still present in large amounts. The North Star, Sunset, Old Glory, Lucky Boy and Discovery properties are reported as having veins that show gold in panning.

SAN BERNARDINO COUNTY

California Trona—This company is doing development work on the Searles Lake properties. The wells are being sunk 75 to 100 ft. deep in developing the saline deposits. The trona deposit is also being developed. The chief value of the Searles Lake property is its deposits of trona and other forms of carbonate of soda. The potash will be treated as a by-product. S. W. Austin was recently appointed receiver of the company.

SIERRA COUNTY

Fruitvale—A quartz mill is to be installed at this mine, near Alleghany, this season. A. Fitzgerald has charge of the property.

Tightner—A shoot of ore, 100 ft. long and from 30 to 40 ft. wide, with a raise of over 100 ft., all in good milling ore, has recently been developed at this mine. About 6 ft. of this ore, along the footwall, is rich, as is usually the case along the serpentine contact in this county.

Telegraph—Additional men have been put to work on power drills at this mine, to drive the cutoff tunnel, being run to shorten the distance into the pay gravel. J. W. Finney is superintendent.

SISKIYOU COUNTY

Siskiyou River Bend Mining Co.—This company, operating on Klamath River, near Walker, has purchased nearly 60,000 ft. of yellow pine, at $2 per thousand, from the Government Forest Service, to be used in the completion of the flume.

Michigan Salmon Co.—A hydraulic elevator has been installed on Know-Nothing Creek. There is plenty of water to operate the giants during the greater part of the season.

Bennett Mining Co.—This company is operating the Crapo placers with three giants. The company has leased the Nigger Hill hydraulic property to Gorham McNeil.

Colorado

BOULDER COUNTY

It is stated that tungsten ore and concentrates worth $50,000 have been shipped this month by the Primos and Wolf Tongue companies. The Primos company will sink the Conger shaft to 1000 ft., and is overhauling its mill. The Wolf Tongue mill is running steadily.

CLEAR CREEK COUNTY

Bellevue-Hudson—It is reported that a streak of high-grade gold-silver ore 8 to 12 in. wide, has been found by August Swanson & Co., leasers.

CRIPPLE CREEK DISTRICT

Moose — This property, with Peter Busch as manager, has three sets of leasers at work and is producing from eight to 10 cars per month.

Montrose—Young & Herron, leasers, have opened a new orebody.

El Paso—A report is current that J. Darnell, lessee, has made a strike of rich sylvanite ore, but the company refuses to give particulars.

Elkton—On No. 1 level of the Walter vein a strike of high-grade sylvanite and free-gold ore has been made.

LAKE COUNTY—LEADVILLE

The properties being worked in the upper down-town district are the Chip, Hope, Ypsilanti, Luzerne, Jolly, Buckeye Bell and Elk.

Winthrop Gold Mining Co.—In Big and Little English Gulches, 1000 acres have been secured under bond and lease by this company; J. M. Moore, of Leadville, is president, and Harry Robinson, Denver, secretary. The ground will be worked from the Crescent tunnel which will be driven 2000 ft. John Murray is superintendent.

Hayden—Shipments of carbonate of zinc ore are again going out regularly.

Big Four—This mine has two shafts working, and lessees are shipping good ore from both.

Jolly—A 3-ft. vein of zinc ore has been opened in this mine at the head of East Fifth Street. Shipments are also going out from a body of iron ore, which was found in prospecting for the zinc ore.

Lillian—J. C. Hersey and associates are shipping fair gold ore from the lease on the north side of the Lillian in Iowa Gulch, and Murcrary has a car of gold ore ready for shipment from his lease on the same mine, in addition to the regular output of zinc ore.

Castle View—This mine is said to have enough ore opened to continue hoisting 45 tons per day for many months. The Yankee Doodle work is being done through the Castle View shaft.

Fairplay—Manager Corey expects soon to double the shipments from this mine in Adelaide Park.

OURAY COUNTY

Camp Bird—It is estimated that the company made a net profit of £36,874 during March.

SAGUACHE COUNTY

Rawley Mining Co.—The large tunnel, which is to be 6000 ft. long, is now in 4000 ft., and is said to have cut three veins of ore. A 16-mile narrow-gage branch from Villa Grove, on the Rio Grande R.R., is said to be projected by that line. W. C. Russell is manager of the Rawley company.

Idaho

COUER D'ALENE DISTRICT

Bunker Hill & Sullivan—The company's new concentrator, costing $375,000, was placed in commission recently. It has a capacity of 35,000 tons per month, and is operated electrically.

IDAHO COUNTY

McRae-Goldman—Good ore has been found in this mine and the owners, the American Development Co., 42 Broadway, New York, are preparing to erect a 20-stamp mill this summer to be in operation by Oct. 15, this year.

Michigan

COPPER

Hancock—No. 2 vertical shaft continues sinking below 3500 ft., and is nearing the point where the Pewabic lode should be cut; when this is accomplished, lateral development will be carried on. A crosscut is being extended to open the formation cut by the shaft at the 34th level.

La Salle—It is rumored that the Tecumseh mine is to be reopened soon. Underground conditions were satisfactory when operations were suspended. With the advance in the price of copper, the property can probably be worked advantageously.

Indiana—The shaft is sinking below 775 ft. At the 65-ft. level, the crosscut has opened a formation about 30 ft. wide, carrying copper in encouraging quantities. This formation is being developed.

Osceola Consolidated—The hearing in the Turner injunction case was held before Judge Weist, at Lansing, on Apr. 22. In the examination of W. J. Uren, the latter acknowledged that he was in error in his charges against the management of the company, and also that his calculations on the operation of the North Kearsarge branch of the company were based on mistaken assumptions.

IRON

Mary Charlotte—This mine, at Negaunee, has changed from the three 8-hr. shift system to two 8-hr. shifts. About 100 of the 150 men who worked on the third shift have been discharged and the remaining 50 put on the other

two shifts. The two shifts will now work from 7:30 a.m. to 4 p.m., and from 7:30 p.m. to 4 a.m., with a half-hour off for lunch in each case.

Iron County Steel Co.—A contract has been let by this Iron River company to Andrew Peterson, for exploratory work on the Jesse Armitage 40-acre tract; a test pit has been sunk to bedrock.

Oliver Iron Mining Co.—The diamond drill on Lake Michigamme, in Brown's Bay, has been taken off. The Cole & McDonald Exploration Co. has moved the drill to the shore near-by, where a deep hole is being drilled. This is on the strip of iron formation extending west from the old Michigamme mine, along the north shore of Lake Michigamme. Drilling by the Oliver company and the Jones & Laughlin company still continues in the Republic district.

Marquette County Gas & Electric Co.—This company, which operates the street railway between Ishpeming and Negaunee, and which has been taken over by the L. E. Myers Co., of Chicago, has proposed to furnish electric power to mines in the vicinity for pumping, hoisting and air compressing. A representative from the Chicago office has been figuring with several of the smaller mine operators. The power is generated by steam.

American—This mine of M. A. Hanna & Co., 10 miles west of Ishpeming, has let a contract for the erection of a concentrating mill to treat 40% iron ore of which the property contains a large amount. The mill will have one unit of a capacity of 500 tons per day and will be so constructed that more units can be added if desirable; electricity will be the power.

Missouri

Central States—This mine at Duenweg recently made a turn-in of 456,000 lb. of calamine.

Meese—This company, operating on the Snapp land at Thoms Station, has made a strike of rich ore in a drill hole, the cuttings assaying 27 per cent.

Montana

Butte District

Butte-Alex Scott—On the 1700-ft. level, the drift has been driven 235 ft. on an orebody 30 ft. wide and this ore is being shipped. When the West Colusa shaft is 2000 ft. deep a raise will be driven to connect with the Alex Scott shaft. C. J. Stone is superintendent.

Deer Lodge County

Hidden Lake—A vein 8 ft. wide has been intersected in a tunnel on this group of mines, in the Georgetown mining district. The vein is 2500 ft. west of the Gold Bug vein, which is the largest in the group. A winze is being sunk on the Gold Bug vein, and is 85 ft. below the tunnel level, in ore all the way. The condition of the roads makes it impossible to ship ore at present, but there are several stockpiles, which will be shipped as soon as the roads are passable.

Garnet County

Nelson—A force of 10 men is working on the 100-ft. level of this mine at Summit, and regular shipments of ore are being made to the Shafter mill, a mile from the property. The ore is being taken from a 3-ft. vein of first-class milling ore, and work will soon be started in a tunnel which will intersect the vein at an estimated depth of 500 ft. Upon the completion of this, the company intends to build a mill of its own at the mouth of the tunnel.

Jefferson County

Boston & Corbin—Plans have been practically completed for the erection of a 200-ton concentrator on the property, at a cost of between $85,000 and $100,000. The tests on the ore have indicated that the company, with its own plant, can produce copper at about 5c. per lb., after crediting the silver and gold in the ore to operating costs. Although the company has sufficient capital in the treasury at present to erect the mill, it has been decided to issue 10,000 shares of treasury stock in order to have working capital when production begins, which will probably be next October. A meeting of stockholders will be held May 6, to authorize this issue by the directors.

Comet—Denver men, who believed that the vein in the bottom of this old mine, near Wickes, assayed 20% zinc, recently pumped the water from the property and found that the average of the assays from the samples taken was only about 4% zinc; the mine was again closed down after about a week taken for the inspection. The property was mined for gold and silver over 30 years ago.

Nevada

Churchill County

Nevada-Hills—The mill, which has been closed since about Jan. 1, due to freezing of the company's water supply for power purposes, resumed operation Apr. 15. It is reported to be working satisfactorily at full capacity.

Clark County

Yellow Pine—The new concentrating plant has been operated successfully during the last three months and now makes a monthly production of 1200 tons of zinc concentrate and 250 tons of lead concentrate. Oil-burners have been installed and the plant is lighted throughout by electricity. At the mine, development is progressing steadily and a large body of lead-zinc carbonate ore was recently discovered on the 200-ft. level, north of the shaft. This orebody has been followed 60 ft. on its dip, and a drift has been started to intersect it on the 300-ft. level. Bodies of high-grade zinc carbonate ore have been opened on the 500-ft. level and shipments will begin soon. The new Shay engine, recently purchased to operate on the company's narrow-gage railroad from the mine to Jean, is doing satisfactory work. Charles K. Barnes, of Los Angeles, is general manager of the company.

Prairie Flower—This property, adjoining the Yellow Pine on the north, is under lease to George Meacham, J. A. Fredrickson and M. G. Wadey. Considerable development has been done and shipments of zinc carbonate ore will be resumed soon.

Comstock Lode

Ophir—Work has been resumed in the southwest drift on the 2500-ft. level, in a strong vein. The header is about 100 ft. north of a point under the first oreshoot cut on the 2400-ft. level, where a stope was carried up 48 ft. in second-class ore.

Mexican—Second-class ore is being stoped from the 2300- and 2400-ft. levels, and work has started in the west fork of the vein on the 2500-ft. level. The mill is running on ore from the surface reserve dumps, and last week treated 402 tons, averaging $24.28 per ton.

Andes—Work has been resumed in the west drift from the 350 station of the shaft. This drift was extended to the diorite wall, but on breaking through, fractures were found on the other side containing copper carbonate and oxide. Occasional high assays in gold have been found, and the drift will be extended further west.

Segregated Belcher—A raise has been started on the 1100-ft. level, near the west stope, and 12 in. of ore in the top have given assays of $50. The raise will be continued up along the course of the ore streak.

Esmeralda County

Goldfield Merger—The 7x18-ft. shaft is 900 ft. deep and sinking about 140 ft. per month. Above the 600-ft. level, the shaft passed through two bodies of quartz. No lateral work will be done until considerable more depth has been attained.

Atlanta—The meeting to elect new officers and directors has been postponed until May 8. The first work is expected to consist in driving from the deepest level of the 1300-ft. Grizzly Bear shaft of the Consolidated into Atlanta ground, and after this to raise to the present Atlanta shafts, which are about 600 ft. deep.

Goldfield Midway—The controlling interest has passed to Philadelphia men. The officers are Peter B. Reed, president; George W. Eaton, vice-president. Ar-

rangements are underway to sink the main shaft to 500 ft., at which point it is intended to crosscut.

HUMBOLDT COUNTY

Mines Development Co.—This company is reported to be doing some development work in the Juniper Mountain district, about 25 miles west of Lovelock. The ore is said to contain gold, silver and copper.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Apr. 18, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,200	52,519
Tonopah-Belmont	1,850	34,276
Montana-Tonopah	1,047	16,024
Tonopah Extension	980	15,002
West End	790	11,139
Midway	.....	180
MacNamara	440	4,937
North Star	.....	40
Totals	8,307	134,117
Estimated value	$207,675	.....

Tonopah Mining—The company's March statement shows that 14,706 tons of ore were milled of an average grade of $19.15 per ton, with total returns of $206,650 and 100 tons of concentrates, worth $44,700; the net profits for the month amounted to $150,940.

Tonopah-Midway—The extension of the vein of high-grade ore opened recently in the 565-ft. level of the Montana-Tonopah has been found at corresponding depth in this mine.

WHITE PINE COUNTY

Argus-Monitor—This mine at Taylor was examined and sampled recently by engineers, supposedly for the Tonopah Mining Company.

Nevada Consolidated—During the first quarter of 1912, net profits were 1,233,767, and production amounted to 17,578,450 lb. of copper.

New Mexico

GRANT COUNTY

Oro Grande—It is reported that these claims, sometimes known as the Apache Box, have been sold by W. N. Small and John Kniffin to Smith Brothers, of Boston and Springfield, Mass., for a large amount. It is further reported that the intention is to erect soon a 200-ton cyanide mill.

Chemung—It is rumored that Phelps, Dodge & Co., have relinquished their option on this property, that the Chemung company plans to consolidate with an adjoining property, and that active mining operations will be resumed.

SANTA FÉ COUNTY

Santa Fé—H. F. Wierum, consulting engineer, is at the property, arranging for the resumption of work at the mine and smeltery. Operations are expected to start about June 15. Additional machinery has been contracted for. Sufficient ore is said to be opened to supply the smeltery for several years.

SOCORRO COUNTY

Deadwood—The mine has been unwatered below the 300-ft. level and within 10 days the lower workings will probably be drained. A new orebody has been opened on the 200-ft. level.

Socorro—The 700-ft. level is the best yet opened in the mine and the shaft development indicates even better ore on the 800 level.

Ernestine—The second cleanup for April is being smelted. Mine developments continue in satisfactory ore.

Oaks—The Pacific tunnel has passed through the oxidized zone into sulphide ores.

Treasure—A large tonnage of reserve ore is accumulating. Two hundred tons per day are being broken, of which 70 tons are being drawn and transported to the mill.

Oregon

BAKER COUNTY

Bonanza—At this mine a drift is being driven to connect a portion of the workings with a shaft, but no ore is being produced at present.

Ibex—It is reported that this property, which was closed down during the winter, will resume about June 1, and that a mill will be installed during the summer.

Cougar—The property has recently been taken over by Spokane men, and active operations will probably be resumed.

Mammoth—A second-hand stamp mill, purchased from the Golden Chariot company, is being erected at this property.

Dixie Meadows—This property, controlled by a New York syndicate, headed by L. Vogelstein & Co., and closed down since Jan. 1, is still idle, and it is not reported when operations will be resumed.

Highland—A 50-ton mill has been completed, and hereafter the product, which has been shipped direct to smelteries, will be milled.

Tennessee

Tennessee Copper—Present production amounts to about 1,250,000 lb. of copper per month and 600 tons of sulphuric acid per day.

Southern Calcium Phosphate Co.—This company, organized at Chattanooga, and capitalized at $2,500,000 will erect plants at Atlanta, Hillsdale and Macon, Ga., so it is reported, and also at Montgomery, Birmingham, Selma and Mobile, Ala. The plan is to manufacture fertilizer without sulphuric acid, using a process invented by George Fishburne, president of the company.

Texas

Holloway—Another gas well has been brought in on this tract near Petrolia, and is reported to be running more than 25,000,000 ft. per day.

Utah

BEAVER COUNTY

Indian Queen—This property is being worked under lease, with intermittent shipments. The work will probably be taken over by the company, at the expiration of the lease in June.

JUAB COUNTY

Chief Consolidated—Work is being done in ore at the south end of the 1400-ft. level; also out into the Townsite territory on the same level.

Gold Chain—Ore is being mined from the 300-, 400- and 700-ft. levels, and drifting for this ore will be started on the 1000-ft. level.

Victoria—Ore is being followed on the 1200, the deepest level. A statement to stockholders is being prepared and will be issued soon.

Beck Tunnel—The indebtedness is being reduced monthly. A drift has been driven from the Humbug stope 150 ft., showing some ore all the way. The most important work at present is being done on the 175-ft. level, where drifting is being done on the vein opened in the tunnel level farther north.

Black Jack—Work through the Star shaft continues, and a cave has been opened on the 300-ft. level. Some fair shipping ore left in the old stopes on the 100 is being broken down for shipment.

SALT LAKE COUNTY

Ohio Copper—During the first week of April, the amount of ore handled by the mill was lowered to 1500 tons per day, on account of mechanical difficulties. The average for the following eight days was 1960 tons. The ore treated recently has carried a high excess of iron, reducing both the ratio of concentration and the usual amount of copper.

Columbus Consolidated—A car of ore netting $55 per ton has been marketed, and two more of a similar grade are expected soon.

Utah Copper—During the year ended Dec. 31, 1911, reserves were increased about 50%, totaling 301,500,000 tons on Jan. 1, 1912. The estimated copper content decreased from 1.67% to 1.532%. The average content of the ore treated in 1911 was 1.51%, and 93,514,419 lb. of copper were produced at a cost of 7.86c. per pound.

SUMMIT COUNTY

Park City shipments for the week ended Apr. 19 totaled 4,511,380 pounds.

Thompson-Quincy—The limestone-quartzite contact has been cut in the raise, being driven from the 1600-ft. level. The ground is heavy and an incline will probably be driven to reach the contact at another point.

Silver King Coalition—Forces have been increased to 400 men, and the output for the week ended Apr. 19 was 1079

tons. This tonnage is larger than formerly.

New York Bonanza—A strike is reported between the 200- and 300-ft. levels, about 150 ft. from the shaft. During March 94 tons of ore were shipped.

UTAH COUNTY

Eva—Shipments have been resumed and six cars are reported ready for the market.

Canada

ONTARIO

St. Anthony—Gold production is being well maintained at this Sturgeon Lake mine. A gold brick containing 200 oz. was shipped recently, being the sixth sent out since operations were resumed. A new compressor and three boilers of 100 hp. each, have been installed and 10 machine drills are at work underground.

Hughes—The main shaft is 100 feet deep and a crosscut will be run from this point to intercept the vein. At the 50-ft. level there were 11 ft. of quartz with only a 4-in. pay streak.

ONTARIO-COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 26, and for the year to date, are:

	Week	Year
La Rose	76.42	1074.70
Coniagas	.....	546.35
O'Brien	.....	199.78
Right of Way	.....	110.30
Chambers-Ferland	.....	129.60
McKinley-Darragh	78.07	920.72
Nipissing	79.88	553.00
Hudson Bay	.....	249.88
Buffalo	28.35	350.73
Crown Reserve	21.37	170.48
Cobalt Townsite	56.17	376.48
City of Cobalt	.....	145.84
Trethewey	.....	147.06
Colonial	.....	20.00
Kerr Lake	.....	231.48
Cobalt Lake	.....	136.01
Drummond	.....	300.32
Temiskaming	.....	260.37
Beaver	.....	101.99
Wettlaufer	.....	111.21
Provincial	.....	22.22
Casey Cobalt	.....	24.50
Totals	340.26	6,182.78

BULLION SHIPMENTS IN OUNCES

Mine	Week	Year to Date
Nipissing	65,848.00	1,190,348.52

Arrangements have been made whereby the low-grade ore from the Kerr Lake and the Crown Reserve mines, formerly sent to the Nova Scotia mill, will be treated by the Northern Customs concentrator, which has increased its capacity.

Wettlaufer-Lorrain—During the quarter ended Mar. 31, 106 tons of ore were mined, yielding 264,683 oz. of silver. Total costs were 19.289c. per oz. and profit 38.61c. per oz. Development work amounted to 456.5 ft., but disclosed no new orebodies, although it opened milling ore. Drifting was done on the Keeley property but results were discouraging and the option was given up. Other properties were investigated but with negative results.

Nipissing—The following financial statement as of Apr. 1 has been issued: Cash in bank, $1,091,826; ore in transit and at smelteries, $254,936; ore sacked for shipment, $203,650 and $1,550,412 total.

La Rose—The financial statement as of Apr. 1 shows: Cash in bank, ore in transit and at smelteries, $1,619,476; ore sacked ready for shipment $89,841 and $1,709,318 total.

Donaldson—A plant is being installed as rapidly as possible at this Elk Lake mine, and is expected to be ready for operation in a few days.

Regal—This property, which immediately adjoins the Donaldson at Elk Lake, will be developed under the supervision of N. R. Morrison. The plant of the Big Six has been purchased.

ONTARIO-PORCUPINE

Three Nations—A narrow vein of rich ore has been found in the drift on the 100-ft. level.

Keora—Work has ceased on this property for the present. Negotiations for its purchase are under way.

Crown Chartered—Recent development is giving satisfactory results, good ore having been encountered in the deepest workings.

La Palme—Negotiations are under way for the purchase of this property by Montreal men.

Porcupine Lake—The vein under the lake has been cut by the diamond drill at a depth of about 400 feet.

Dome—This company has made its first shipment of bullion amounting to 1600 oz. worth $25,000. Owing to slight trouble with the Pachuca tanks the full complement of stamps is not yet running. This defect will be remedied soon, when the 40 stamps will be put in operation.

McIntyre—This company has shipped over $11,000 worth of bullion from the 10-stamp mill.

Timmins Syndicate—Contracts have been let to George Harris for sinking two shafts on the Miller-Middleton properties, west of the Hollinger, and one shaft on the Dixon south of the McIntyre.

Miller-Porcupine—At a meeting to be held May 4, the shareholders will authorize the directors to negotiate a sale of all or part of the company's property.

Jowsey—This property, comprising 260 acres on which six veins have been uncovered, has been purchased by the Gold Peak Mining Company.

North Dome—At the 50-ft. level a lens of quartz showing visible gold has been found in a crosscut 34 ft. from B shaft. The drift from the main shaft is also in ore.

Scottish-Ontario—This mine has been unwatered and the property made ready for inspection by a representative of the English syndicate that has a controlling interest in it. The examination is expected to determine whether further development will be undertaken.

Mulholland—The main shaft is down 160 ft. Drifting on the 100-ft. level shows the vein about 8 ft. in width, carrying good ore. A second level will be run at 200 ft. Electrical machinery will be installed. W. S. Edwards, of the Dome, is president of the company.

Hollinger—This winze below the 200-ft. level is down 21 ft. Since the publication of the annual report the following work has been accomplished: On the 100-ft. level, 423 ft. of drifting on the No. 2 vein, 288 ft. on the No. 4 vein, 69 ft. on the No. 8 vein and 26 ft. of sinking on the No. 1 vein; on the 200-ft. level, 137 ft. of drifting on No. 1 vein, 85 ft. on the No. 2 vein and 134 ft. of crosscutting to reach No. 4 vein. Mr. Robbins states that the results of this work bear out the conclusions given in his report.

Mexico

Dispatches state that the U. S. Army transport "Buford" left San Francisco on Apr. 28, for points on the west coast of Mexico, to take off refugees.

Mines Company of America—During the year ended Dec. 31, 1911, the company paid dividends of $798,917. Total receipts were $702,808; expenditures, $17,472; net profit, $685,336 equal to 8.29% on the outstanding capital stock.

CHIHUAHUA

La Republica—During the quarter ended Mar. 31, 2683 tons of ore were milled, worth 173,774 pesos; operating charges were 129,560 pesos; construction and equipment, 21,690 pesos. Gordon Hardy, consulting engineer, states that operations are greatly hampered and restricted by insufficient labor and other handicaps due to revolutionary troubles.

NUEVO LEON

Soledad—A 4-ft. vein of good gold and silver ore is reported to have been opened on the north side of the dike that cuts the Mololoa vein.

SONORA

Calumet & Sonora—No actual mining work is being done at present but the mill is treating accumulated ore. It is expected that the mill will close soon. It is rumored that negotiations are pending for the sale of the property.

South America

PERU

The discovery of emeralds is reported from the Department of Cuzco. The property is 12 km. from Chuquicahuana, in the Cerro Takee-Ccacca, 13,500 ft. above sea level and is reached by a good road. Mr. Colmenares, of Lima, has denounced the property.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, May 1—The coal trade in the West is gradually settling down, as the district scales are adjusted on the new basis. Trade is rather quiet, as many large consumers are well stocked.

The anthracite sub-committee has agreed upon a compromise plan, which is to be submitted to the general committee for approval. Briefly this plan provides for an increase of 10 per cent. in wages; the abolition of the present sliding scale; a new arrangement of local committees for the adjustment of minor differences which may arise from time to time, and a partial recognition of the union. It is believed that this compromise will be approved and that work may be resumed before the end of May —by May 15, probably.

Coal and coke carried on all lines of the Pennsylvania R.R. east of Pittsburg and Erie three months ended Mar. 31, short tons:

	1911	1912	Changes
Anthracite	2,988,025	3,288,737	I. 300,710
Bituminous	10,162,175	12,169,935	I. 2,007,760
Coke	2,740,636	3,111,786	I. 371,152
Total	15,890,736	18,570,458	I. 2,679,622

The total increase was 16.9% this year.

Imports of coal into Spain two months ended Feb. 29 were 397,489 metric tons, an increase of 90,333 over 1911. Imports of coke were 78,193 tons, an increase of 29,506 tons.

United States Foreign Trade—Imports of coal and coke in the United States three months ended Mar. 31, long tons:

	1911	1912	Changes
Anthracite	.....	25	I. 25
Bituminous	426,259	364,064	D. 62,195
Coke	37,791	21,521	D. 16,270
Total	464,050	385,610	D. 78,440

Canada furnished this year 316,759 tons of coal and nearly all the coke; Australia 40,483 tons of coal.

Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, three months ended Mar. 31, long tons:

	1911	1912	Changes
Anthracite	608,291	730,811	I. 122,520
Bituminous	2,174,121	2,336,014	I. 161,893
Coke	257,893	183,043	D. 74,850
Bunker coal	1,552,885	1,751,919	I. 199,034
Total	4,593,190	5 001,787	I. 1,408,597

The bunker or steamship coal is practically all bituminous. Canada took this year 2,020,969 tons of coal; Cuba and the West Indies, 452,151; Mexico, 81,614; Panama, 80,160 tons.

Iron Trade Review

New York, May 1—The iron and steel markets continue strong, and indications are favorable for some time to come.

In finished material, mills are generally working well up toward capacity, in almost all lines. Prices continue to firm up and in all advances are the rule. Structural material seems to lag behind as far as prices are concerned, and orders are still taken at pretty low figures. The railroads are doing more in ordering cars and bridge work, while good rail orders are gradually coming in.

In pig iron basic has been especially active and some good tonnages have been placed. Foundry iron has also sold well, and there are reports that some bessemer pig will be taken from merchant furnaces. Prices are firmer and sellers are holding to advances, especially in seaboard territory.

Export trade is active. The coal strike in England sent some European orders here, owing to the stoppage of English works. Our mills have some bids in on a large quantity of rails for Canada.

United States Steel Corporation—The statement for the quarter ended Mar. 31 is as follows:

Net earnings	1911	1912
January	$5,869,416	$5,243,406
February	7,180,928	5,427,320
March	10,468,859	7,156,247
Total	$23,519,203	$17,826,973
Depreciation, etc		$4,148,444
Internal and sinking funds		7,311,963
Total charges		$11,460,407
Surplus for the quarter		$6,366,566
Dividend, 1¾% on preferred		$6,304,919
Dividend, 1¼% on common		6,353,781
Total dividends		$12,658,700
Deficit		$6,292,134

The surplus for the quarter compares with $12,689,855 for the corresponding quarter last year. The usual dividends on both preferred and common stock were declared for the quarter, although the common dividend was not earned.

The earnings reported by the Steel Corporation for the first quarter were smaller than generally assumed in the trade. In some quarters the suggestion is made that as trade prospects have greatly improved, the allowances were on a liberal scale, resulting in low earnings, as a basis for the better showing which is expected for the second quarter. We estimate the Corporation's shipments in the quarter to about 2,600,000 tons, which would mean earnings of about $6.75 per ton. This compares with $11.01 in 1911 and $16.59 in 1902, which year showed the maximum earnings per ton. Shipments during the current quarter should reach or exceed 3,000,000 tons, and while the current shipments are chiefly on old contracts, the average realized price should be somewhat higher than in the first quarter. An average increase of $1.25 per ton would make $8 per ton profits in this quarter, so that earnings would run about $25,000,000. According to last year's showing the Corporation requires precisely $100,000,000 to meet all charges, including the regular dividends.

Birmingham

Apr. 29— There has been a steady selling of pig iron by Southern makers and general reports are most encouraging. Inquiry elicits the information that practically every manufacturer of iron in this section of the country has sold during the present month considerably more iron than was produced. It is now estimated that by June 1 there will be bare storage yards noted. It is announced that during the coming month two blast furnaces will resume operation in order that all demands can be met promptly. The quotations for iron are firm at $11 per ton, No. 2 foundry. Sales are not mentioned any more at $10.50 and $10.75, but all talk is to the effect that $11 is the price. There is no probability of higher quotations being realized in the near future. The report of another sale of 20,000 tons is heard, making something like 110,000 tons of pig iron sold to cast-iron pipe interests in the last 30 days. The pipe makers have orders in hand and others in sight that promise to keep the plants going for many months yet.

Steel conditions, in fabricated steel, rails and steel-wire goods, are taking on a little strength in the South. Charcoal iron is a little firmer, too, with the prices still $22@22.50 per ton. The make is not very large and will not be at any time this year, but two or three small furnaces are prepared to produce charcoal iron. Scrap iron is demanding a little more attention.

Chicago

Apr. 30—There has been a large sale of pig iron in the last week, and the outlook, from the seller's point of view, is decidedly better. Lots of 1000 to 5000 tons have been disposed of in the last

fortnight, and the tendency is toward increasing confidence in the future and larger sales among all the melters. In consequence, prices are firm.

No. 2 Northern iron now brings $14.50 @15, at the furnace, and No. 2 Southern $10.50@11, Birmingham, which is equivalent to $14.85@15.35, Chicago. At these prices, most of the business for the third quarter and last half is being done, though in some cases slightly higher prices are asked for last-half delivery. Lake Superior charcoal is firm at $16@17 per ton.

The demand for iron and steel products has not been materially checked by advances in prices applying nominally for the last 10 days of the month, but practically spreading out to become effective in May. On structural material there is firmness generally and a slowly increasing demand for bridge and building work, which, with the adjustment of labor troubles, seems bound to go rapidly forward. Railroad purchases in this respect continue good, with 1.43c. generally asked, for Chicago delivery. Railroad supplies sell well, with a number of orders for standard rails pending and track fastenings in very good demand. Bars are active, with the probability of a slackening of business on May 1; soft-steel bars bring 1.33@1.38c., and iron bars 1.15@1.20c., with the lower prices predominating. Plates are actively in demand, at 1.43c. for ¼-in. tank plates. The demand for sheets and wire goods is reported very good, with country trade especially active. General business conditions are encouraging for heavier business in the future.

Cleveland

April 29—The Lake begins to look like an early opening, and a pretty good lot of ore is expected in May.

Pig Iron—Activity continues. The recent sales have been largely of basic and malleable iron. Basic is firmer and $13, furnace, is asked on recent sales. Other quotations, Cleveland delivery, are $15.15 for bessemer, $13.25@13.50 for No. 2 foundry and $15.50@16 for Lake Superior charcoal.

Finished Material—The buying of bars has subsided for the present. Many contracts were placed before the advance in prices took effect. Structural steel has been active, and has been the prominent feature this week.

Philadelphia

May 1—A few eastern Pennsylvania furnaces, having secured considerable business, have put prices at a point which is checking the placing of additional orders at the present time. Less business has been transacted during the past week. A number of inquiries are pending from New England, New York and New Jersey which total a large amount, but there appears to be no immediate probability of much of this business being closed right away. The most active iron on the list at present is low-grade foundry for summer delivery, but business of this sort is not encouraged by the stronger quotations. The strength of No. 3 foundry seems to be assured by the low condition of stocks and the oversold condition of several Southern furnaces which have been taking the lead in securing business for pipe. Quotations for No. 2 X foundry have been permanently advanced, while gray forge and basic are available at any desired delivery at figures heretofore prevailing. The tone of the entire market has been strengthened by two facts, namely, the depletion of stocks and the volume of inquiries which have actually been made, is likely soon to appear. Quotations are $15@15.50 for No. 2 X, with Southern 25c. or 50c. below, and gray forge and basic at $14.50 per ton.

Steel Billets—Latest quotations for billets show an advance of $1 on open-hearth, without an urgent demand. Consumers are pretty well supplied for the present, but the feeling prevails that billets are likely to go on the war path.

Bars—Bars have advanced enough to stimulate halting demand. The refined is feeling the influence of the strong undertone and jobbers are quite active in replenishing depleted stocks.

Sheets—Sheets have been quiet for the week. The mills are well supplied with business.

Pipes and Tubes—Cast pipe is strong and some recent contracts have been closed on more favorable terms. Tubes are strong with only a moderate few orders.

Plates—Only small orders have been placed for plates, but the large volume of business in sight for car work, ship work and general construction is imparting a tone to the market which makes recent maximum quotations really minimum quotations for summer delivery.

Structural Material—Practically the same condition prevails, but owing to the sold-up condition of car works, immediate orders are hardly probable, while for ship work more encouraging indications are apparent.

Scrap—The cleaning up of desirable scrap continues and quotations were advanced late last week, though the negotiations in hand at previous quotations if closed—as they probably will be—will make a scarcity in the more desirable grades.

Pittsburg

Apr. 30—The iron and steel market has reached an uneventful stage in its development. The price advances are practically over for the time being, and buying by jobbers and ordinary manufacturing consumers is on a light scale, while their specifications on old contracts are good, but by no means phenomenal. There is no quarter from which an added stimulus can come except from the railroads, and it is still confidently expected that they will become heavy buyers within the next 30 to 60 days. This would readily save the situation from the lethargy into which it is likely otherwise to drop when present low-priced contracts are worked out with jobbing and manufacturing consumers. It can hardly be expected that these will quickly take hold at the advanced prices of today as soon as their low-priced contracts run out.

The strongest lines in the market are bars, plates and shapes, which are firmly established on the basis of 1.20c. for bars and 1.25c. for plates and shapes. The line which has experienced the least improvement is wire products. The spring business has proved quite disappointing and the mills are still making deliveries on $1.50 and $1.55 contracts, probably in about equal proportions, and selling very little on the present basis of $1.60. It is not improbable that some $1.50 contracts have been extended when they were really worked out. Mills in the Pittsburg district are operating substantially at full capacity, and have turned out as large tonnages as in March, when many mills made new tonnage records for a month.

Pig Iron—The local pig-iron market has been very quiet. There have been rumors of large inquiries, but little buying seems to result, and the only interesting expectation is that the Steel Corporation will buy a block of bessemer iron, perhaps 20,000 or 25,000 tons. This was under consideration a week ago, but nothing definite has been developed. We continue to quote: Bessemer, $14.15@14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The English makers have made another advance in ferromanganese, dating from Apr. 29, of $2.50, putting the price to $46, Baltimore, freight to Pittsburg being $1.95. The previous advance was $2.50, Apr. 15. Small lots for spot shipment have been bringing $46 up to $50, Baltimore.

Steel—The steel mills are practically out of the market for any early delivery of billets or sheet bars, and there are only occasional offerings by brokers, so that the market is largely nominal. We quote billets at $20.50, and small billets and sheet bars at $21, f.o.b. maker's mill, Pittsburg or Youngstown. Wire rods are $25, Pittsburg. There is very little fresh demand for any of these products, consumers being well covered, but specifications on contracts are very heavy.

Sheets—The market does not seem to firm up any further, despite the fact that

the leading interest withdrew to the extent of quoting a minimum of 1.95c. on black and 3.00c. on galvanized. While 1.90c. on black and 2.90c. on galvanized can be quoted as the market, instances are frequently coming out of these prices being shaded $1 a ton. We quote painted corrugated at $1.35 per square and galvanized at $2.55 per square, these prices being sometimes shaded. The American Sheet & Tin Plate Co.'s extras are 5c. per 100 lb. for corrugating, and 15c. extra for painting gages 25 to 28, inclusive.

St. Louis

Apr. 29—The demand for pig iron continues quite brisk. A number of inquiries have been coming in for delivery during the third and fourth quarters. The demand for finished products remains fairly good. The steel foundries and railway-supply companies all seem to have a good volume of business.

No. 2 foundry is bringing from $10.50 for immediate shipment to $11 for third-quarter shipment, f.o.b. Birmingham, or $14.25@14.75, f.o.b. St. Louis. Northern iron is being quoted around $14.50 per ton. The demand for Northern iron is light.

Connellsville foundry coke is bringing $5@5.15 per ton, St. Louis.

Iron Ore Trade

Nearly all the large buyers of Lake ore seem to be supplied, and buying is slow. The ice on the Lakes is going off rapidly and the first shipments of ore down are expected this week, having already left Duluth.

The first cargo of ore from Wabana, Newfoundland, is expected at Philadelphia this week. It is understood that contracts already made for this ore cover between 150,000 and 175,000 tons.

METAL MARKETS

New York, May 1—The metal markets show comparatively little change. The principal incident has been a sharp advance in tin.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Mar. 1912..	$ 7,453,589	$ 4,336,67	Exp. $3,117,911
" 1911..	505,615	4,119,063	Imp. 3,613,448
Year 1912..	19,958,088	12,414,195	Exp. 7,543,893
" 1911..	1,854,014	19,465,737	Imp. 17,611,723
Silver			
Mar. 1912..	5,806,307	3,711,734	Exp. 2,094,573
" 1911..	5,896,795	3,197,409	Exp. 2,699,386
Year 1912..	16,955,988	11,850,220	Exp. 5,105,768
" 1911..	16,001,842	10,646,781	Exp. 5,355,061

Exports from the port of New York, week ended Apr. 27: Gold, $564,733, chiefly to Argentina; silver, $872,939, principally to London. Imports: Gold, $216,266; silver, $149,534, from Central and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving went to the Bank of England.

Iridium—Prices are unchanged at $64 per oz. for pure metal, New York.

Platinum—Business is quiet and prices are unchanged. Dealers ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

The Consolidated Goldfields of South Africa have purchased La Lozana and some adjoining platinum properties near Buena Ventura, Colombia. This probably means that those properties will be systematically worked.

Silver—The market advanced this week to 28 1/16d. in London, the highest point touched on the recent rise. The strength of the market is due to good buying for the Indian Bazaars and to Continental purchasers; and while there may be some reaction, the undertone continues strong.

SILVER AND STERLING EXCHANGE

Apr.-May	25	26	27	29	30	1
New York....	60 3/4	60 3/4	60 3/4	60 5/8	61 1/4	61 1/4
London ..	27 1/2	28	27 1/2	27 1/2	28 1/16	28 1/16
Sterling Ex..	4.8705	4.8705	4.8700	4.8690	4.8675	4.8670

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver. 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 18, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£3,023,500	£2,213,300	D. £810,200
China.....	752,800	520,000	D. 232,800
Total	£3,776,300	£2,733,300	D. £1,043,000

India Council bills in London averaged 16.4d. per rupee for the week.

Copper, Tin, Lead and Zinc

LONDON

Apr.-May	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
25	70 1/4	71 1/8	75 1/4	203 1/2	199 3/4	16 5/8	25 3/4
26	70 5/16	71 3/16	75 1/4	206	202 1/2	16 1/2	25 3/4
27	.....	.....	.....	.....	.....	.....	.....
29	70 11/16	71 7/16	75 1/2	212	209	16 1/2	25 3/4
30	70 3/8	71 3/16	75 1/4	210 1/2	208	16 1/2	25 3/4
1	70 5/16	71	75 1/4	210 3/4	208 3/4	16 1/2	25 3/4

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The business during the week of Apr. 25-May 1 was very light, transactions having amounted to but a few millions of pounds. These were chiefly for domestic account, there having been no demand from Europe. The speculative offerings to which we referred last week seem to have been cleaned up, and the recent business has been done by first hands, several of the agencies having made sales at 15.80@15.87½c., delivered, usual terms. But little business in Lake copper has been reported to us, and the quotations for that kind are largely nominal. The relative stagnation of the market this week and the slightly lower prices accepted are not considered in the trade to be indicative of any impending change in the situation. Manufacturers, both in this country and in Europe, are very busy, but being well supplied with copper and having bought considerable ahead, are at the moment not buying. Producers, on the other hand, are in a very comfortable position, and generally are holding firm for their prices. At the close, Lake copper is quoted at 15⅞@16c., and electrolytic copper in cakes, wirebars and ingots at 15.65@15.75c., while casting is quoted nominally at 15½@15⅝c. as the average for the week.

The standard market in London has been dull and has fluctuated within narrow limits. On Monday, spot sold at £70 13s. 9d. and three months at £71 11s. 3d., and on Wednesday it closed at £70 3s. 9d. for spot and £71 for three months.

The additions to the Baltimore copper refinery have now been completed and put into use. The present capacity of this refinery is about 24,000,000 lb. per month. At the Raritan refinery the old tank house is being rebuilt along the lines of the new one.

NEW YORK

Apr.-May	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
25	15⅞ @16	15.70 @15.80	44½	4.20	4.07½ @4.10	6.65 @6.80	6.50 @6.65
26	15⅞ @16	15.65 @15.75	45	4.20	4.05 @4.07½	6.65 @6.80	6.50 @6.65
27	15⅞ @16	15.65 @15.75	45¼	4.20	4.05 @4.07½	6.65 @6.80	6.50 @6.65
29	15⅞ @16	15.65 @15.75	46⅛	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6 60
30	15⅞ @16	15.65 @15.75	46¼	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6.60
1	15⅞ @16	15.65 @15 75	46⅜	4.20	4.05 @4.07½	6.65 @6.75	6.50 @6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 5215 long tons. Our special correspondent gives the exports from Baltimore at 1430 tons.

Tin—While during last week the metal evinced stubborn strength and advanced in an orderly fashion, the market became very much excited the beginning of this week. Quotations were advanced by leaps and bounds, buying became general, and transactions increased to large proportions. At one time during the excitement three months' tin touched £215. This movement is due to the excellent statistical position of the metal and its continually increasing consumption, especially in this country. Conditions have become quieter at this writing, and the market closes steady at £210 15s. for spot and £208 15s. for three months, and at 46⅜c. here for May tin.

Tin output of Federated Malay States in 1911: Perak, 437,339; Selangor, 231,175; N. Sembilan, 29,230; Pahang, 43,954; total, 741,698 pikuls, or 44,149 long tons. This is an increase of 286 tons over the previous year.

Arrivals of Bolivian tin in England in March, as reproted by H. A. Watson & Co., included 2247 tons concentrates and 8 tons bars; equivalent to 1356 tons fine tin.

Lead—The market is quiet and transactions have taken place in Western lead at slightly lower figures. At the close, St. Louis is quoted at 4.05@4.07½c. and New York at 4.20 cents.

The London market is somewhat easier, Spanish lead being quoted at £16 10s., and English 2s. 6d. higher.

Spelter—The demand for this metal has been light and offerings to large buyers have been met by bids that have not been entertained. The quantity of metal available for early delivery has increased materially and this has brought the market into more normal condition. During this change there has naturally been some irregularity in transactions according to the extent of shopping. During the early part of the week spelter for May delivery realized 6.65c., St. Louis, but during the latter part was available at 6.60c., while June-July was offered at 6.50c.

The London market for spelter is quiet, good ordinaries being quoted at £25 15s., and specials at £26 per ton.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is qucted at 7⅛c. per lb., New York.

Other Metals

Aluminum—Business has been more active, and there have been a number of sales. Prices are firmer and we quote 20½@22c. per lb. for No. 1 ingots, New York.

The foreign market has had a good advance on the statement that the old aluminum syndicate will be renewed. Ingots cannot be bought for less than 15c. This has caused the advance here.

Antimony—Business remains quiet and prices are unchanged. Cookson's is 8 @8⅛c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business is good again, but prices here are unchanged. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. The London price was dropped from £8 12s. 6d. to £8 early in the week, but today is raised again to £8 5s. per flask; while £8 is asked by second hands.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 50@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, three months ended Mar. 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	96,342	47,906	Exp. 48,436
Copper, 1911	76,683	37,691	Exp. 38,992
Tin, long tons	119	12,793	Imp. 12,644
Tin, 1911	101	13,972	Imp. 13,871
Lead, short tons	17,768	25,801	Imp. 8,033
Lead, 1911	18,211	21,343	Imp. 3,132
Zinc, short tons	2,985	2,209	Exp. 776
Zinc, 1911	1,079	579	Exp. 500
Nickel, lb.	6,265,120	8,441,230	Imp. 2,176,110
Nickel, 1911	6,121,318	7,195,391	Imp. 1,074,073
Antimony, lb.	40,320	3,274,270	Imp. 3,233,950
Antimony, 1911	150,704	1,641,670	Imp. 1,491,966
Platinum, oz	.....	21,205	Imp. 21,205
Platinum, 1911	47	27,579	Imp. 27,532
Aluminum, lb.	9,656	6,233,754	Imp. 6,224,098
Aluminum, 1911	.....	.....	.....
Ores, etc.			
Zinc in ore, lb	9,174,701	7,201,306	Exp. 1,973,395
In ore 1911	4,874,020	10,853,519	Imp. 5,979,499
Zinc oxide, lb.	7,870,415	.....	Exp. 7,870,415
Zinc oxide, '11	6,177,577	.....	Exp. 6,177,577
Zinc dross, lb.	352,650	.....	Exp. 352,650
Zinc dross, '11	1,187,482	.....	Exp. 1,187,482
Chrome ore, l.t.	.....	16,851	Imp. 16,851
Chrome ore, '11	.....	11,479	Imp. 11,479

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 11,824 tons; exported, 7660. Imports of aluminum were not reported previous to July 1, 1911. The metal exports given above include reexports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., Apr. 27—The highest price paid this week for zinc ore was $53.50 the base price, 60% zinc, was $52. The base price paid for 80% lead ore was $53@54 per ton.

SHIPMENTS, WEEK ENDED APR. 27

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	983,300	.....	.....
Galena	777,600	65,400	.....
Benton	560,000	.....	522,100
Platteville	408,500	.....	.....
Cuba City	319,500	166,860	80,000
Hazel Green	300,000	120,000	.....
Shullsburg	281,500	.....	.....
Rewey	82,000	.....	.....
Harker	64,000	.....	.....
Linden	.....	.....	60,000
Total	3,776,400	352,260	662,100
Year to date	64,295,440	2,121,790	7,541,750

Shipped during week to separating plants, 1,544,110 lb. zinc ore.

Joplin, Mo., Apr. 27—The high price of zinc sulphide ore is $56, the base price, per ton of 60% zinc, $50@54. Zinc silicate base $25@28 per ton of 40% zinc. Average price, all grades of zinc, $51.08. Lead ore sold from $52 to $55, at an average of $53.80 per ton.

Realizing that increasing shipments of Western zinc ore are moving toward the smelters, sellers become more willing to accept current offerings, and buying was easier on practically the same offerings as last week.

SHIPMENTS, WEEK ENDED APR. 27

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,825,700	.....	879,190	$149,106
Joplin	1,997,730	.....	153,240	57,075
Miami	698,960	.....	555,430	30,345
Galena	853,220	.....	.....	22,180
Alba-Neck	558,860	.....	24,090	15,726
Duenweg	486,650	.....	61,230	14,304
Cave Springs	360,260	.....	.....	9,725
Oronogo	251,620	.....	.....	9,206
Spurgeon	62 690	191,450	178,710	9,195
Carl Junction	205,000	.....	.....	5,740
Granby	88,410	115,030	12,920	3,605
Carthage	125,300	.....	.....	3,140
Jackson	56,320	.....	16,230	1,840
Wentworth	61,220	.....	.....	1,530
Quapaw	51,870	.....	.....	1,190
Totals	10,783,800	306,480	1,881,040	$333,907
4 mos	169,815,440	10,019,260	28,461,820	$4,984,288
Blende val., the week, $278,755;		4 mos.,		$4,057,108
Calamine, the week, 4,553;		4 mos.,		143,568
Lead value, the week, 50,601;		4 mos.,		783,614

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, May 1—Business continues unchanged and the markets generally are in good condition.

Copper Sulphate—Business is good. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand continues good and supplies are still scarce. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is steady and quotations are unchanged at 2.40c. per lb. for spot, and 2.40c. for future positions up to Aug. 1; while 2.35c. is asked for deliveries later than that date.

Current Wholesale Prices

Ammonium sulphate.....cwt.	3.40
Arsenic, white.....lb.	0.03¾@0.04
Barytes, ground.....sh. ton	12.50@14.00
" floated.....sh. ton	16.00@17.00
Calcium acetate, gray.....cwt.	2.25@2.30
carbide, ton lots f.o.b. Niagara Falls..sh. ton	70.00
Carbons, good drill quality, carat	75.00@85.00
Cement, Port., Am. 400-lb. bbl.	1.33
Chrome brick, f.o.b., Pittsburg M.	175.00
ore, 50%, ex-ship, N. Y., lg. ton	14.00@16.00
Copperas, bulk.....cwt.	0.55
bbl.....cwt.	0.60@0.85
Copper sulphate.....cwt.	5.25@5.50
Fluorspar, lump, f.o.b. Pittsburg, ton	8.00@9.00
Magnesite, crude, 95%....lg. ton	7.50@8.50
calcined, powdered...	26.00@35.00
brick, dom. f.o.b. Pittsburg.....M.	160@180
Paints, litharge, Am. powd...lb.	0.05½@0.06
red lead, American...lb.	0.06½@0.07
white lead, Am., dry..lb.	0.05½@0.05¾
zinc white, Am., dry...lb.	0.05½@0.06¼
Phosphates, acid:	
*Fla., hard rock 77%.....	5.75@6.25
land pebble 68%.....	3.70@3.80
†Tenn., 78@80%.....	5.00@5.50
75%.....	4.75@5.00
68@72%.....	4.25@4.50
‡So. Car. land rock 60%.....	3.50@3.75
Potassium cyanide, 98@99%..lb.	0.19
Pyrite:	
Domestic, non-arsenical, furnace size, f.o.b. R.R. per unit	0.12@0.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines.....	0.11½@0.12
Imported, non-arsenical, furnace size, ex-ship, per unit..	0.13½
Imported, arsenical, furnace size, ex-ship, per unit.....	0.12¾@0.13
Imported, fines, arsenical, ex-ship.....	0.11@0.12
Imported, fines non-arsenical, ex-ship, per unit.....	0.12½

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

Sodium cyanide, 120 to 130% KCN (per 100%)...lb.	0.18
nitrate 95% spot....cwt.	2.40
95% future..cwt.	2.35
Sulphur, Louisiana prime, N. Y., lg. ton	22.00@22.50
roll.....cwt.	1.85@2.15
flour.....cwt.	2.00@2.40
flowers, sublimed...cwt.	2.20@2.60
pow. com., bags....cwt.	1.50
Sicilian, crude brimstone.....lg. ton	22.50
Zinc chloride, granular.....lb.	0.04½@0.04½

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.

Petroleum

Petroleum production in California in March was 7,289,498 bbl.; shipments, 6,551,765 bbl. There were 53 new wells completed in March.

Exports of mineral oils from the United States in March were 122,254,481 gal. For the three months ended Mar. 31 the exports were 378,797,345 gal. in 1911, and 353,663,751 gal. in 1912; a decrease of 25,133,594 gal., or 6.6%, this year.

Mining Stocks

New York, May 1—On Apr. 25, the Exchange was active but inclined to be irregular, with advances in a few special stocks. On the Curb there were many dealings in the copper stocks generally at small advances. Cobalt shares were uncertain, while there was a fair demand for other mining stocks.

Apr. 26, the Curb was active and sales of mining stocks were large, the coppers leading; but Cobalts and Nevada gold shares also sold well. Prices were irregular, showing both gains and losses of fractions. The Exchange was also active in a few specialties, but rather quiet for the rest of the list.

Apr. 27 again showed a rather irregular market. Amalgamated Copper remained strong. The Curb was also inclined to be variable, on a fair amount of business. Coppers generally held their own, but other mining stocks were off a little.

Apr. 29, the Exchange was active, but mainly on a few special lines. Amalgamated Copper touched a high at 85, and Steel common was firm. On the Curb a fair business was done in copper stocks, but other mining stocks were rather heavy.

Apr. 30 the Exchange was halting and stationary. Steel common, however, advanced, making a high price at 72¼. The Curb was rather hesitating and mining stocks were variable and uncertain. May 1 the Exchange and Curb were both rather reactionary, but with only slight changes in prices. The Steel Corporation's March statement had litte effect on the stock.

Boston, Apr. 30—Outside of a few specialties the copper-share market has toned down somewhat, but not at all to the detriment of optimistic sentiment. The feature of the market was the $11 rise in the price of St. Mary's Mineral Land shares to a high of $67. From this, however, a reaction of $3.25 followed. A big block of the stock was recently taken over privately at around $60, and this proved an incentive for quite an active speculation in the stock. Different valuations of the company have been given, varying all the way from the present market price up to $200 per share.

Results of diamond-drill operations have again brought Indiana to the fore and caused a $2.50 advance to $23. Old Colony made a new high record at $13, a rise of 1.87½. Little of interest is heard from either this or the Mayflower

Copper Production Reports

Copper contents of blister copper, in pounds

Company	Feb.	March	Jan.
Alaska shipments.	2,662,243	4,987,916	.....
Anaconda.....	27,450,000	25,900,000	.....
Arizona, Ltd.....	3,020,000	3,150 000	.....
Copper Queen.....	6,046,860	7,197,121	.....
Calumet & Ariz....	4,452,004	4,652,000	.....
Detroit.....	2,068,370	2,246,238	.....
East Butte.....	1,440,000	.....	.....
Mammoth.....	1,722,954	1,939,310	.....
Mason Valley.....	1,100,000	.....	.....
Nevada Con.....	4,888,790	6,380,000	.....
Old Dominion.....	2,039,000	.....	.....
Ray.....	2,140,000	.....	.....
Shannon.....	1,300,000	1,388,000	.....
South Utah.....	283.838	299,000	.....
United Verde*.....	2,250,000	.....	.....
Utah Copper Co....	8,612,739	8,160,000	.....
Lake Superior*....	19,000,000	19,750,000	.....
Non-rep. mines*...	8,000,000	8,400,000	.....
Total production.	98,476,798	.....	.....
Imports, bars, etc..	18,976,513	23,519,215	.....
Total blister.....	117,453,311	.....	.....
Imp. in ore & matte	10,432,438	8,736,874	.....
Total.....	127,885,749	.....	.....
Miami.....	2,475,996	2,755,000	.....
Brit. Col. Cos.:			
British Col. Copper	860,003	.....	.....
Granby.....	1,773,496	1,882,073	.....
Mexican Cos.:			
Boleo.....	2,204,720	2,424,800	.....
Cananea.....	2,948,000	2,834,000	.....
Moctezuma.....	2,687,712	2,446,731	.....
Other Foreign:			
Cape Cop., S. Africa	786,440	725,760	.....
Kyshtim, Russia...	1,055,000	.....	.....
Spassky, Russia...	649,600	.....	.....
Famatina, Argen..	.....	.....	.....
Tilt Cove, Newf'd..	109,059	104,992	.....
Exports from:			
Chile.....	6,720,000	3,584,000	.....
Australia.....	7,164,000	8,064,000	.....
Arrivals in Europe†	10,868,680	12,559,680	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

Statistics of Copper.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
IV, 1911.....	118,085,223	52,407,650	62,129,599
V.....	126,962,544	64,543,963	61,978,557
VI.....	124,554,312	61,655,561	71,460,519
VII.....	112,167,934	56,982,582	74,880,658
VIII.....	125,493,667	59,935,364	69,855,660
IX.....	115,588,950	57,311,584	50,824,011
X.....	118,255,442	64,068,307	60,084,349
XI.....	111,876,601	68,039,776	67,049,279
XII.....	122,896,697	65,988,474	79,238,716
Year, 1911...	1,431,938,338	709,611,605	754,902,233
I, 1912.....	119,337.753	62,343,901	80,167.904
II.....	116,035,809	56,228,368	63.148,096
III.....	125,694,601	67,487,466	58,779,566
IV.....	.....	.....	.....

	Visible Stocks		
	United States	Europe	Total
V, 1911.....	165,555,908	212,284,800	377,840,708
VI.....	165,995,932	202,540,800	368,536,732
VII.....	157,434,164	195,932,800	353,366,964
VIII.....	137,738,858	191,891,840	329,630,698
IX.....	133,441,501	191,228,800	324,670,301
X.....	140,894,856	191,945,600	332,840,456
XI.....	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912.....	89.454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III.....	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757
V.....	.....	.....	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

property. Activity is mainly in the Lake Superior issues, although Nevada Consolidated rose almost $2 today to $21.87½.

Trading on the Curb has slackened somewhat, although a firm tone is maintained. First National is one of the most active stocks.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	.....	$1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Black Jack, Utah	Feb. 6	.....	0.01
Bullion, Nev	Apr. 30	May 20	0.05
Caledonia, Nev	May 21	June 11	0.10
Cedar-Talisman, Utah	Apr. 20	.....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Ely Con., Nev	.....	.....	0.05
Exchequer, Nev	May 23	June 13	0.05
Federal Ely, Utah	May 8	June 8	0.01
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	.....	1.00
Houghton Copper, Mich	May 17	.....	1.00
Julia, Nev	May 15	June 5	0.05
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	.....	0.01½
Lower Mammoth, Utah	Mar. 16	.....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	.....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	.....	1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	.....	0.10
Southwestern Miami, Ariz	Jan. 15	.....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	.....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62 893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15 741	12.275	15.930	54.034	70.294
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.260	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42.400	.....
February	41 614	42.962	August	43.319	.....
March	40.157	42.577	September	39 755	.....
April	42 185	43.923	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4 200	4.262	4.158	12.889	16.331
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6 483	23.743	25.643
May	5.348	.....	5.198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26 801	.....
September	5 869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 30

Name of Comp.	Bid.
Acacia	‡.05½
Cripple Cr'k Con.	‡.01½
C. K. & N.	‡ 18
Doctor Jack Pot	.06½
Elkton Con	.66⅞
El Paso	.78⅝
Findlay	.04
Gold Dollar	.15¾
Gold Sovereign	‡.02
Isabella	.11¾
Jack Pot	.06
Jennie Sample	.06
Lexington	‡ 01
Moon Anchor	‡ 01
Old Gold	.03⅝
Mary McKinney	.67
Pharmacist	.02
Portland	.90
Vindicator	.70½
Work	‡.01

SALT LAKE Apr. 30

Name of Comp.	Bid.
Beck Tunnel	.14
Black Jack	.20
Cedar Talisman	.02
Colorado Mining	.19½
Columbus Con	.18½
Crown Point	.03¾
Daly-Judge	‡6.00
Grand Central	.68
Iron Blossom	1.20
Little Bell	.40
Lower Mammoth	.02½
Mason Valley	11.50
May Day	.10
Nevada Hills	2.31
New York	‡.06
Prince Con	1.42½
Silver King Coal'n	2.00
Sioux Con	.03¾
Uncle Sam	.20
Yankee	‡.10

TORONTO Apr. 30

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.80	Hollinger	12.00
Hudson Bay	‡70.00	Imperial	.04
Temiskaming	.39	Pearl Lake	.15
Wettlaufer-Lor	.64	Porcu. Gold	.35
Apex	.04	Porcu. Tisdale	.04
Central	‡5 56	Preston E. D	.05
Crown Chartered	.26	Rea	.50
Dobie	.45	Standard	.03
Dome Exten	.52	Swastika	.20
Foley O'Brien	.21	West Dome	.15

SAN FRANCISCO Apr. 30

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.20
Belcher	.62
Best & Belcher	.16
Caledonia	1.25
Challenge Con	.18
Chollar	.08
Confidence	.73
Con. Virginia	.81
Crown Point	.70
Gould & Curry	.07
Hale & Norcross	.23
Mexican	3.42½
Occidental	.60
Ophir	1.42½
Overman	1.15
Potosi	.07
Savage	.14
Sierra Nevada	.34
Union Con	1.05
Yellow Jacket	.88

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	10.40
Jim Butler	.68
MacNamara	.25
Midway	.73
Mont.-Tonopah	3.42½
North Star	.25
West End Con	2.20
Atlanta	.26
Booth	.11
C.O.D. Con	.11
Comb. Frac	.16
Jumbo Extension	.46
Pitts.-Silver Peak	1.40
Silver Pick	.14
St. Ives	.30
Tramp Con	‡.01
Argonaut	2.25
Bunker Hill	5.00
Cent. Eureka	.80
So. Eureka	‡5.00

N. Y. EXCH. Apr. 30

Name of Comp.	Clg.
Amalgamated	83¼
Am. Agri. Chem	60¾
Am.Sm.&Ref.,com	85¾
Am. Sm. & Ref., pf.	107⅛
Am. Sm. Sec., pf. B	87½
Anaconda	42⅝
Batopilas Min	2¼
BethlehemSteelpf	72
Chino	29½
Federal M. & S., pf.	43
Goldfield Con	4¼
GreatNor.,ore,ctf.	40⅞
Homestake	93
Miami Copper	25½
Nat'nalLead,com	57¾
National Lead, pf.	107
Nev. Consol	21⅛
Pittsburg Coal, pf.	88
Ray Con	19⅛
Republic I.&S,com.	24¾
Republic I & S, pf.	81
SlossSheffi'd,com.	49
Sloss Sheffield, pf.	‡100
Tennessee Copper	44½
Utah Copper	63¼
U. S. Steel, com	72½
U. S. Steel, pf.	113¼
Va. Car. Chem	51¾

N. Y. CURB Apr. 30

Name of Comp.	Clg.
Barnes King	⅛
Beaver Con	.46
Braden Copper	5¼
B. C. Copper	5¾
Buffalo Mines	‡1¾
Butte & Vipond	‡.53
Caledonia	⅜
Con. Ariz. Sm	⅜
Davis-Daly	1⅜
Diam'field-Daisy	10
Ely Con	5/16
Florence	.78
Giroux	5⅞
Gold Hill Con	‡¼
Greene Cananea	9
Greenwater	.08
Guggen. Exp	230
Inspiration Con	19⅛
Internat. S. & R	‡126
LaGrange Placer	‡2⅜
Kerr Lake	2⅞
La Rose	3⅝
McKinley-Dar-Sa	1¼
Min. Co. of A. new	3
Nev. Utah M. & S.	1/16
Nipissing Mines	7⅞
Ohio Copper	1⅛
Pacific Sm. & M	⅛
Precious Metals	‡1⅜
Ray Central	2⅜
Red Warrior	‡1⅛
South Utah M. & S.	1
Standard Oil (Old)	880
Stand'd Oil of N.J.	386
Stand'd Oil Subs.	490
Stewart	1⅛
Tonopah	7⅛
Tonopah Ex	1⅞
Tri-Bullion	11/16
Tularosa	13/16
United Cop., pfd.	15
Yukon Gold	3⅛

LONDON May 1

Name of Com.	Clg.
Camp Bird	£1 9s 9d
Dolores	1 10 0
El Oro	0 17 0
Esperanza	1 13 9
Mexico Mines	6 16 3
Oroville	0 4 3
Stratton'sInd.	0 3 1½
Tomboy	1 3 0

BOSTON EXCH. Apr. 30

Name of Comp.	Clg.
Adventure	8¾
Ahmeek	300
Algomah	7¼
Allouez	46
Am. Zinc	30¾
Ariz. Com., ctfs.	5½
Bonanza	½
Boston & Corbin	7⅛
Butte & Balak	4½
Calumet & Ariz	73½
Calumet & Hecla	491
Centennial	25½
Con. Mercur	‡.06
Copper Range	63¼
Daly West	5⅝
East Butte	13¾
Franklin	13½
Granby	57¼
Hancock	32½
Hedley Gold	‡17
Helvetia	1½
Indiana	20¾
Island Cr'k, com	46
Island Cr'k, pfd.	88
Isle Royale	27
Keweenaw	2
Lake	44½
La Salle	7¾
Mass	7½
Michigan	3½
Mohawk	63½
New Arcadian	5
New Idria Quick	‡6⅞
North Butte	30¼
North Lake	7½
Ojibway	4⅞
Old Dominion	54
Osceola	118
Quincy	90¾
Shannon	14
Shattuck-Ariz	‡21
Superior	37
Superior & Bost	2⅝
Tamarack	44
Trinity	7½
Tuolumne	3½
Union Mines	‡3⅞
U. S. Smelting	37
U. S. Smelt'g, pf.	49
Utah Apex	‡2⅜
Utah Con	14
Victoria	4¾
Winona	6
Wolverine	111
Wyandot	2¾

BOSTON CURB Apr. 30

Name of Comp.	Last
Bingham Mines	2⅛
Boston Ely	.13/16
Boswyocolo	.08½
Butte Central	8
Cactus	.12
Calaveras	2⅜
Chief Cons	1½
Corbin	2⅜
Cortez	1
Crown Reserve	3
First Nat. Cop	3.3/16
Majestic	.77
Mazatan	‡.60
Moneta Porc	.15
Nevada-Douglas	3.7/16
New Baltic	3½
Oneco	3⅜
Raven Copper	.37
Rhode Island Coal	.20
San Antonio	‡3
S. W. Miami	8⅜
South Lake	7½
Trethewey	.60
United Verde Ext.	.45
Vulture	‡5.00

‡Last quotation.